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ABSTRACT

The objective of the project was to develop a method of measuring benefits, to provide criterion functions for quantitative planning in university libraries. The approach chosen was to show what benefit estimates lie behind actual qualitative planning decisions and to build them into exact planning models. The chapters include: library products and services; maximization of library resources; simulation of user decision processes; problems, purposes and methods of data collection; a current awareness service for social scientists; the use of collected data, a historical review of the project, and suggestions for further work. Appendices provide information for model-building for the inversion process, library stock, bookstock, welfare economics, data guides, a prospectus for university libraries, data conversion and surveys of unrecorded use. (AB)

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UNIVERSITY OF DURHAM

PROJECT FOR EVALUATING THE BENEFITS FROM UNIVERSITY LIBRARIES

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FINAL REPORT

October 1969

(reprinted April 1970
" January 1971)

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SUMMARY OF FINAL REPORT ON PEBUL

The objective of the project was to develop a method of measuring benefit, to provide criterion functions for quantitative planning in university libraries.

The approach chosen was to show what benefit estimates lie behind actual qualitative planning decisions and to build them into exact planning models.

The method developed can be applied in assessing social or "intangible" benefits in any situation for which a planning model can be built lacking only a benefit criterion. It works backwards from the policies adopted to the criteria that must have been implicit in choosing them. Once the criteria are found, they can be used in forward planning. The benefit analysis method may thus be described as the "inversion of acriteric models."

The model-building and inversion process has been carried to field trial stage for a medium-term linear programming model of resource allocation within the university library, and to dummy run stage for a psychological model of the decision process lying behind the behaviour of a library user.

The first results of the inversion of the resource-allocation model were that the library managers in Durham University in Summer 1968 behaved as if 1 item of new stock added to the library was worth the same as 4.6 items on inter-library loan from elsewhere or 1300 hours spent by users in consulting material in the library or 90 items on long loan or 200 items on short loan or 3.3 hours spent by senior librarians in advising users or 9.1 hours spent by junior librarians in advising users.

Extensive surveys of library use and users have been carried out in the Universities of Durham and Newcastle-upon-Tyne, placing particular reliance on the "instant diary" method developed by the PEBUL team. The data, which has been analysed in various ways for the purposes of the project, forms one of the most complete sets of facts on library use ever assembled and is available for further analysis for other purposes.

An experimental Current Awareness Service was provided for two years for social scientists in Durham to investigate the effects on their behaviour and attitudes of the provision of new facilities, and resulted in definite pressure for further provision of such services.

The main conclusion of the study is that benefits from libraries can be measured by observing users' behaviour and librarians' decisions, so that the exact techniques of modern management can be applied, while preserving the value scales evolved qualitatively through experience and insight.

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PREFACE

This is the final report on the Project for Evaluating the Benefits from University Libraries (PEBUL), carried out at the University of Durham with the financial support of the Office for Scientific and Technical Information (OSTI) from 1 October 1966 to 31 July 1969.

The Principal Investigators were John Hawgood B A, D Phil, Director of the University of Durham Computer Unit, Richard Morley B Sc (Econ), Lecturer in Economics in the University of Durham, and for the academic year 1967-68, Maurice B Line M A, F L A, then Deputy Librarian of Newcastle University and now Librarian of Bath University of Tehnology. The project started as a result of the interest of Richard Morley in Welfare Economics (particularly as applied to education) and in the application of linear programming, and the interest of John Hawgood in operational research in non-commercial situations, catalysed by a suggestion from a member of the organisation later known as OSTI that libraries would be a good subject for economic and operational research investigation. It soon became clear that a major obstacle to exact study of libraries was the absence of quantitative criteria for achievement, and the rest of our work has sprung from this. The OSTI grants (SI/26/13) totalling £14,527 supported a multi-disciplinary team of varying composition, the only member who served throughout being Lt Col W E M Morris, B A, F I W M, who organised all the surveys, wrote many of the reports and coordinated all the work of the team. From March 1967 Mrs Jean Hopkins B A (Econ) was Information Officer providing and evaluating the Current Awareness Service, and from 1 January 1968 M G Ford B Sc, Dip Lib, A L A, F G S, provided full-time library expertise and did much of the model-building. Other members of the research team were R N Oddy B A, (1966-67), Mrs K V Romain B A, M L S, (1967), B Bennetto B Sc (1968) and Mrs G E Wenban-Smith (1968). Secretarial work was done by Mrs J Jobling and Mrs B Butcher, and card punching by Mrs F Smith and Mrs V Wilson. We wish to express our heartfelt thanks to all of these for their help, without which the project could not have been carried out.

Our choice of the University Library as the particular type of library to study, and of Durham in particular, was then an obvious one, given the friendly relations we enjoyed with the library staff (remarkably, we still do) and their willingness to give us the benefit of their enormous combined erudition, experience, and originality. We are most grateful to the whole staff of Durham University Library, in particular to Miss A M McAulay (Librarian), Mr I J C Foster (Keeper of Oriental Books), Dr A I Doyle (Keeper of Rare Books) and Mr B Woodward (Keeper of Science Books). Also we should like to thank the staff of Newcastle University Library,

particularly Dr W S Mitchell (Librarian) and Mr A E Jeffreys (Chief Cataloguer), for their cooperation. We have also received much help in our surveys from members of staff and students in both universities; they are too numerous to name but we thank them all most warmly.

Much help came through contacts both formal and informal with others working in the field, particularly Michael Buckland and Ian Woodburn at Lancaster University, W L Saunders and Miss J E Friedman at Sheffield University, W B Easterfield of the Ministry of Technology and Brian Perry and David May of OSTI; we are most grateful to them.

Responsibility for this report is collective, but particular team members have written particular chapters as indicated in the Contents list. We hope the Report is complete enough in itself to inform those new to our work about it, but will be glad to provide further details, or facilities for doing further analyses of our data, to anyone interested.

John Hawgood
Richard Morley

October 1969

CHAPTER 1

INTRODUCTION

When this project started the problem of university libraries was in the minds of many people. On the one hand, many librarians were busy improving their libraries and had good reasons why other apparent improvements would in practice make matters worse. On the other hand, many users were dissatisfied with the rate of improvement. Further questioning of users resulted in the traditional dialogue: "I cannot get what I want from the library because it is inefficient." "Yes, but how do you know the library is inefficient?" "Because I cannot get what I want."

Efficiency is a nebulous concept except in the simplest types of productive enterprises. In any event it depends upon a clear understanding of what is being produced, how this production can be measured, and what the value of the production is. In this project we addressed ourselves to answering these three questions. It can be described as a logical sequence of three phases with progessively narrowing focus:

1 The development of a general approach to the measurement of benefits through the construction of planning models

2 The construction of computer models relevant to planning problems in the university library field

3 The gathering of relevant data for calibration of the models to apply to particular universities

As the historical account in Chapter 9 shows, these threads were interwoven throughout the course of our research, but for this Final Report we have followed the logical rather than the chronological sequence.

The structure of the Report is therefore as follows: we start with an introduction to our approach to benefit analysis, in the later part of this chapter; then follow three chapters on our models and the economic technical and psychological factors involved in building them; in Chapters 5 to 8 we give an account of our data-collection activities, including the experimental Current Awareness Service used to study the adaptation of users to new facilities; the main text is concluded by the historical review and some suggestions in Chapter 10 about possible future extensions of our work. A number of appendices contain matter addressed principally to those with special interests in operational research, librarianship or economics.

The remainder of this chapter is concerned with the use of models in planning and our "inversion" technique enabling them to be used for benefit analysis.

Models with criteria in forward planning

Because it is impossible to cater for every eventuality all managers must use simplified models of real situations when making decisions about the allocation of resources or the scheduling of activities. The transition from simple model to complex reality is analogous to the transition from the "broad-brush" concerns of top management to the "nuts-and-bolts" concerns of lower management. Usually the model exists only in the manager's mind, though he may commit part of it to paper or use it as the basis of a computer program. As part of the model, he needs a criterion by which he can choose between the alternatives he is considering. This criterion may be explicit and quantitative ("maximise the profit") but even in commerce it is likely to be partly subjective or implicit because of multiple objectives or "intangible" benefits. In non-commercial situations it is rare for the manager to have a quantitative objective function to maximise; he may have been assigned a target to be attained at minimum cost, but usually there is no way of measuring the comparative value of different possible objectives.

It is therefore likely that the criterion for forward planning in a non-commercial situation is qualitative; this does not mean it does not lead to good planning, but it does mean that there is a difficulty in exact definition and communication of the criterion. No two people can be sure they are using the same criterion, and there may be a partial loss of effective control in the organisation. Communication and constructive criticism are easier when the criterion is explicit and quantitative.

Models without criteria in benefit analysis

We want to quantify and make explicit the qualitative maximising criterion which the manager uses in a non-commercial situation such as the university library: our method is to build a planning model without a criterion, and apply it retrospectively to actual decisions - effectively we run the planning machine backwards from decision to criterion. We determine what benefit functions would have led to the actual decisions if the model had been used: the method may be described as "benefit analysis by inversion of acriteric planning models".

For this approach to be valid in the strictest sense it is necessary that the actual decisions taken were optimal. Few managers would claim that every decision they have made was the best possible, but we contend that the interaction between decisions on resource allocation for a current period and decisions on resource adjustment for future periods does ensure near-optimality in most cases, in the way described in the next two paragraphs, and illustrated in Appendix 1.

When a manager in a pure profit-maximising situation uses linear programming to help him to determine the deployment of his resources, he takes as given both the constraints imposed by these resources and the profit function which is his criterion. The results of the linear programming calculation tell him not only how to make the most profit from the given resources, but how much extra profit he could make following small adjustments to the resources; such adjustments will normally be made for future periods.

In a non-commercial situation, the manager has resource constraints but usually no explicit benefit function. He will take his decision in the light of his subjective judgment and will find that some resources are scarce while others will be wasted. In succeeding periods he will seek adjustments to his resources or his unit costs to keep the balance right, and this iterative process causes the operating point eventually to be where all the important resources are nearly used up. The operation becomes "efficient" and the decisions "optimal" in the technical sense.

The optimality, and the existence of a number of decisions taken in similar situations but with slightly different resources or costs, make possible the inversion of the planning model to determine the range of benefit functions which would lead to the actual policies, as described in Appendix 1. A single inversion calculation can seldom yield a unique benefit function - almost always there will be a considerable range, which may be narrowed by considering a number of decisions in similar situations.

Stages in the inversion process

To summarise and generalise, the proposed technique for benefit analysis involves the following stages, the first four of which have been reached in our experiments:

1 Choose a planning situation which recurs in such a way that the benefit function does not change significantly over the chosen set of decisions.

2 Choose a planning technique which could have been

used to aid the responsible manager to make decisions if there had been an explicit quantified benefit criterion.

3 Build a planning model realistic enough for decisions made with its aid to be meaningful in reality, except that it is acriteric (lacks a criterion for choice of the optimal policy).

4 Given a decision made in the real situation, and hence its counterpart in the model, invert the planning process to discover what range of criteria would cause this decision to be chosen as the optimum by the planning process.

5 Repeat for the other decisions in the set, with any different constraints or costs involved, to narrow the range of criteria.

6 Inform the manager of the result and use it in consultation with him to aid his current decision-making on similar questions. Observe his actual decisions and make a revised estimate of the criterion accordingly.

7 Continue until convergence is obtained so that the manager can confidently use the model with its criterion to aid him.

When this last stage is reached we will have provided a tool useful to the manager both in decision-making and in communication to his successor or others in the organisation. Even at the penultimate stage we should be helping the decision-making process by providing extra information to the manager, though he will not yet feel able to use the choices of the model in a routine way.

A model for medium-term planning in the University Library

We have built a linear-programming model for the allocation of resources in university libraries over periods of up to a year, and have carried the process outlined above as far as Stage 4, for the relevant policy adopted in Durham University Library in the Summer Term of 1968, provisionally describing one benefit function, consistent with the policy, as "the" benefit function in dialogue with the librarians. We have carried through a certain number of trials with hypothetical changed circumstances to see what decisions would be produced by the use of this benefit function. The most illuminating results are not so much the resource allocations suggested by the calculation as the highlighting of certain actual or potential bottlenecks in the system and the quantification of the "benefit" to be obtained by removing them.

Chapter 2 describes the resources and activities taken into account in the model, and some costing by-products; Chapter 3 shows how the model can be used for planning once the benefit function is agreed, how we established our trial function by marginal cost considerations, and how to interpret the results of a number of computer runs with different parameters. Another description from a rather different viewpoint is given in Appendix 6, which takes the form of a "Prospectus" addressed to University Librarians. Appendices 2, 3 and 4 elaborate parts of the discussion in Chapter 3 in relation to the necessary bookstock, to the problem of weeding it and to considerations of welfare economics, respectively.

The methods used to collect the library use data required to calibrate the model are described in Chapters 5 and 6 and in Appendix 7, and a selection of the analysed results are discussed in Chapter 8 and Appendix 8.

Work with this model continues, and we hope to carry through Stages 5, 6 and perhaps even 7 over the next year or so in Durham and possibly elsewhere, as outlined in Chapter 10.

A model of a library user's self-scheduling process

We have also built a dynamic simulation model of the psychological decision-making processes involved in the choice by an undergraduate of his place of work for untimetabled hours. The computer program for a simple version of the model has been written and tested with some made-up data as far as Stage 4; the concepts involved and the trial results are discussed in Chapter 4, and possible extensions in Chapter 10.

The object of constructing this type of model in addition to that relating to librarians' decisions is chiefly to aid in longer-term planning - though librarians are well aware of the impact of users' choices in the short run and can predict reliably for the medium-term, it is very difficult for them to guess at the reactions of users to drastic changes in buildings or facilities. For such "strategic" planning we need information about the real value of information to an individual and about his view of the value of his own time, which can be deduced from his behaviour as compared to that of a computer simulation in which these values and costs are made explicit. We also need pointers to changes in behaviour as facilities change, which requires observation during real changes as well as computer simulation of the adaptation process.

Chapter 7 describes our attempt to observe users' reactions to a new facility - a Current Awareness

Service that we provided for two years for a small group of social scientists. As well as being a study of the first stages of "conditioning", it provided considerable information on the ways of providing such a service and the costs involved. Again, Chapters 6 and 8 describe collection of data for calibration of the model and selected results of analyses.

Conclusion

The basic aim of the Project for Evaluating the Benefits from University Libraries was to develop a method for carrying out such evaluations: this we consider has been achieved as far as the general principle is concerned by our origination and trial application of the concept of the "inversion of acriteric planning models". To tie down some details of the technique, and to provide actual results which can be used in planning, will require field trials and further detailed development of the medium-term resource allocation model, and similar further work following experimental calibration of the user-choice model, as outlined in Chapter 10.

We have been enormously impressed by the imaginative, flexible and outward-looking approach to problems of library management achieved by university librarians - far transcending the stereotyped image of the "scholarly custodian". In suggesting that quantified objectives would aid library decision-making we are far from advocating the abandonment of the judgement and skill that now guide the process. On the contrary, we hope that the application of our methods will enable the best of the old techniques to be complemented and supported by the best of the new.

CHAPTER 2

WHAT AND HOW DO UNIVERSITY LIBRARIES PRODUCE?

Libraries present two particular problems to the librarian and the economist. First, nobody will say what precisely libraries are supposed to be doing. Second, the heterogeneity of the book-stock and the variety of the services make any sort of quantitative approach difficult. The two problems are connected: one cannot say one wants more unless one says more of what.

This chapter presents a start at a quantitative approach by finding numerical relationships between the outputs of the library and the resources available. The qualitative considerations are so obvious that we do not think we are misleading anybody. The approach allows further investigation of a number of management problems. As an example, a later section of the chapter shows how the resulting data can be used for comparative costings.

The Activities of the Library

The activities of the library can be divided conveniently into two types, final and intermediate. Final activities are those which are of direct benefit to the community served. They consist of activities such as making information available to users in a variety of ways (books on long or short loan, photocopies of pages, direct answers to reference queries, etc.), "preserving the cultural heritage" (rare books and manuscripts, etc.), anticipating future needs (increasing the book-stock), building up a collection until it becomes of interest to scholars, or contributing to the working of the national library system (loans, advice, etc.).

Intermediate activities are those which are not of direct benefit to users, although they may be an essential part of the production of the final activities. Book-binding, maintaining the building and equipment and such would be intermediate activities. An important intermediate activity is the training of junior librarians in skills which are useful to the specific library. (General training, of use in any library, is in a sense a final activity although it benefits the wider community served by the national library system. We are assuming that most training on the job is specific.)

Here we are concerned only with final activities. For example, cataloguing is treated as part of the activity "increasing the book-stock", a part of the process between selecting the book for ordering and getting it on to the shelf. This is because the catalogue is used mainly as a finding list. If users came to the library solely to consult the catalogue, this consultation would be a final activity. Since they use the catalogue to find a book which they then consult, it seems more reasonable to treat the consultation of the book as the activity rather than the consultation of the catalogue.

(If the university were a market economy instead of a socialist one, the final activities would be those for which a price could be charged to users. They do not include long-term planning, personnel management, or maintenance. The library's publications are not included either, as their main object is to promote library use over a long period).

We consider that the following is a complete list of all the final activities of the library: a bold statement made for the purposes of debate. The list emphasises the warehousing activities of the library, but user services are included and will be elaborated upon in a later chapter.

1. Increasing the book-stock of the library. This can be measured in units of "accession numbers per period of time". If we take the time period as a term, we can consider this activity to be increasing next period's resources, because at most university libraries the period between ordering and shelving a book is several weeks. (A description of the annual cycle of use will be given in a later chapter, after we have found out what is worth describing).

2. Obtaining inter-library loans. In part, this is a substitute for activity (1). Some books, such as textbooks on a reading list, will be required certainly many times a year. Some books might not be required immediately but look like becoming major reference works and so are bought as part of an insurance policy, to insure against disappointment by users in the future. On the other hand, inter-library loans are certainly cheaper and often quicker than book purchases. (A comparison of the costs of the two activities is given in a later section).

3. Providing inter-library loans to other libraries. The majority of loans are arranged between libraries. Even of those handled by NCL only a fifth are from NCL stock. This activity makes (2) viable. (Filon and Gibb, 1966.) Activities (2) and (3) can be measured as number of items per term.

4. Using library material inside the library. This is measured in hours spent by users inside the library: user-hours. We exclude from this activity the use of the short loan collection, and we avoid confusion with the use of the library simply as a place to work (see below).

5. Lending books on long loan. Since the loan

system guarantees a fortnight loan period, after which the book may be recalled, we measure this in book-fortnights. (The peculiar units of measurement are designed to enable us to find out what resources are needed for each activity. We hope this becomes clearer as we go along).

6. Lending short-loan books, measured in book-periods, where a period is half a day.

7. Providing a place to work without using library materials. In Durham and Newcastle 50-60% of all visits to the library are just to find a place to work. Even one-third of the non-university users visit the library for this purpose (not only in Durham and Newcastle, but also in Sydney). Since such users tend to stay longer than others, perhaps three-quarters of the users in the library at any one time are not using library material at all.

This is, of course, an extremely important activity. However, cheap substitutes can be found, for example by leaving a nearby lecture room open and heated. If short-loan collections expand and become popular, this substitute may have to be used when a shortage of seating develops. The substitution is not perfect: many people work in the library in case they need to use some of the book-stock (e.g. consulting a dictionary when translating). There is also a certain ambience about a library that appeals to many users. The level of the activity is measured in user-hours.

8. Photocopying. This is an activity which is complementary to other activities: it enhances the value of the book-stock to the user. The level of this activity is measured in units of 100 items photocopied.

9. Providing the services from specialised equipment, such as micro-copy readers or teaching machines. The level of the activity is measured in terms of the hours for which the machines are used.

10. User-services from junior librarians. "Where is the economics collection, the catalogue, the loo, the bibliographies, this book, the stairs, the way-out?" and all those questions caused by bad signposting or because many of us do not notice signs, plus many types of advice on form-filling. As with all servicing (solicitors, doctors, MP's, lecturers), the measurement of output is skirted around by measuring input: man-hours spent on user-services.

11. User-services from senior librarians. "Your research project has already been done twice, you know." "I expect you've seen this, but since it happens to be exactly what you want, I thought I'd bring it to your attention, just in case." "Not more people doing research on libraries!" In many

libraries this service may extend to book selection, compiling bibliographies, literature searches, advice on students' reading lists, and attending Boards of Studies. Measurement as for (10).

The resources of the library

The resources are the labour, buildings and equipment available. The only resources listed here are those which are relevant to the production of the final activities. Thus executive labour used for long-term planning and personnel management is ignored.

In the short run (a term, say), most of the resources of the library cannot be varied. Even "unskilled" workers develop an expertise specific to the job they are in; so hiring and firing in response to short-run changes in requirements is not an aid to production - quite apart from labour relations. Over a slightly longer period (a year, say), the labour force can be varied, but we concentrate for the moment on the short run. This allows us to treat all resources as fixed.

We consider the following to be a complete list of the resources relevant to the final activities. In many cases a resource implies several others. For example a book on the shelf implies the shelf as well, but empty shelving must be listed separately. Books plus empty shelving plus seats imply most of the library building.

1. Labour, measured in man-hours available during the period, e.g. for a 35½ hour week during a 9 week term, one librarian is available for 9 x 35½ man-hours.

Senior librarians	(graduates with additional training)
Middle librarians	(senior library assistants)
Junior librarians	
Clerical	
Porters	

2. Book-stock, measured in books per period of time. The actual time period will vary with the types of loan system.

Long loan, in book-fortnights
Short loan, in book periods. There are twelve book periods in one week
Reference, in book hours. A finer classification will be necessary for many problems. Here we mean any book confined to the library, not just major reference works and bibliographical tools

e.g. If the total long loan stock is 10,000, and the period is 9 weeks, there are $10{,}000 \times \frac{9}{2} = 45{,}000$ book fortnights available.

Note that we can double the stock of reference books either by doubling the number of books or by doubling the opening hours. The same applies to seats and machines.

3. Equipment.

Seats, in seat-hours
Machines, in machine-hours
Empty shelves. These are used up by increasing the book-stock. The cost of discarding unwanted books (about 10/- per title, not including the selection of the title) may make it cheaper to build new libraries rather than weed. At least, that is what we assume here. The result is that there is a ratchet effect in using up shelf space, so we can ignore the time period. (For some comments on weeding, see Appendix 3).

4. The uncommitted budget. This is the money available after the other resources have been paid. It seems peculiar to treat money as a fixed resource, but this is due to the institutional arrangements of the university. In the outside world one can sometimes borrow, but in the university there is allocation. This allocation is often so detailed that the budget becomes just sets of vouchers for the purchase of specific items.

The relationship between resources and activities

We now have to find how the library uses the resources to produce the services (although we stick with the operational researcher's jargon and use "activity" for the production of a service).

Some of the relationships are trivial: it takes one hour of a senior librarian's time to produce one hour of user-services from senior librarians.

In many cases the relationships are complex. One activity may use several resources, and one resource may be used for several different activities. These relationships are best put in the form of a table, with each row representing a resource and each column representing an activity. Each to seats and machines.

3. Equipment.

Seats, in seat-hours
Machines, in machine-hours
Empty shelves. These are used up by increasing the book-stock. The cost of discarding unwanted books (about 10/- per title, not including the selection of the title) may make it cheaper to build new libraries rather than weed. At least, that is what we assume here. The result is that there is a ratchet effect in using up shelf space, so we can ignore the time period. (For some comments on weeding, see Appendix 3).

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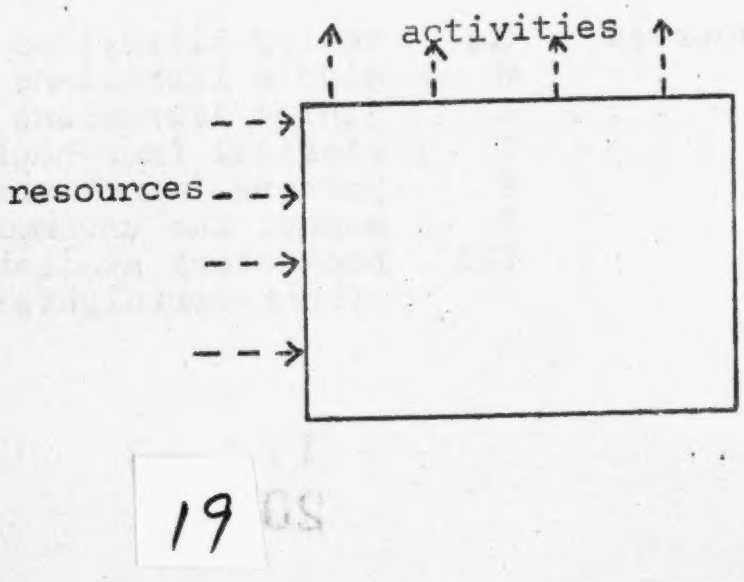
Some of the relationships are trivial: it takes one hour of a senior librarian's time to produce one hour of user-services from senior librarians.

In many cases the relationships are complex. One activity may use several resources, and one resource may be used for several different activities. These relationships are best put in the form of a table, with each row representing a resource and each column representing an activity. Each number shows how many units of that resource (the row) are necessary to produce one unit of each activity.

Conceptually this can be viewed as a transformation of resources into activities.



2.6

The following table shows what these coefficients were for the Arts/Social Science library at Durham at Easter, 1968. We consider these numbers to be accurate to within 10%. We also think that they reflect current practice in many university libraries, and that there is enough constancy over the years for such measurements to be worth making.

	I	OILL	PILL	LML	LL	SL	W	Xer	US	UJ
S	1.2	0.07	0.5	0	0.01	0	0	0	1	0
J	0.3	1.2	1.1	0.006	0.08	0.05	0	0.5	0	1
C	0.3	0	0.25	0	0	0	0	0	0	0
P	0.03	0.2	0.2	0.002	0.002	0	0	0	0	0
£	2.78	0.25	0.25	0	0	0	0	-0.79	0	0
LLS	0	0	2	0.02	1	0	0	0	0	0
SLS	0	0	0	0	0	1	0	0	0	0
RS	0	0	0	n	0	0	0	0	0	0
St	0	0	0	1	0	1	1	0	0	0
Sh	0.1	0	0	0	0	0	0	0	0	0
XerE	n	0	n	0	0	0	0	0.5	0	0

n: The activity uses a small but not zero amount of the resource.

Activities:	I	increasing next period's resources (accession numbers)
	OILL	obtaining inter-library loans (items)
	PILL	providing inter-library loans (items)
	LML	using library material inside library (hours)
	LL	long loans (book-fortnights)
	SL	short loans (book-periods, period = one-twelfth of a week)
	W	a place to work (user-hours)
	Xer	photocopying (units of 100 sheets)
	US	user-services by senior librarians (man-hours)
	UJ	user-services by junior librarians (man-hours)

Resources:	S	senior librarians (man-hours)
	M	middle librarians (man-hours)
	J	junior librarians (man-hours)
	C	clerical (man-hours)
	P	porters (man-hours)
	£	money, the uncommitted budget
	LLS	book-stock available for long loan (book-fortnights)

SLS	book-stock available for short loan (book-periods)
RS	book-stock available for reference only
St	seats (seat-hours)
Sh	empty shelves (feet)
XerE	photocopying equipment (machine-hours)

For example, reading along the £-row, £2.78 of the budget, is used for each unit increase in next period's resources (£2.75 is the average price of books bought at the Arts/Social Science library, it is also the national average for adult non-fiction book prices. To this is added the money cost of photocopying £0.03); £0.25 is the cost of posting back an ILL after it has been obtained (OILL), and £0.25 is also the cost of posting off a book supplied on request from another library (PILL). For each 100 sheets of Xeroxing, the library receives £2.5 and pays out £1.71, leaving £0.79 to be added to the budget (hence the minus sign!)

Reading down the LL-column, it takes about 0.01 hours of a senior librarian's time to supervise one long loan, 0.08 hours of a junior librarian's time, and 0.002 hours of a porter's time. The loan for a fortnight uses up 1 book-fortnight of the library's resources of long loan book stock.

An article could be written, and probably has, on any one of the figures given here. Thus the first three entries in the first column give the labour requirements for "cat. and class." together with ordering and shelving for one book. The work of the NELCG on linking acquisitions and cataloguing data is obviously concentrating on a crucial area. (NELCG, 1968, also Friedman and Jeffreys, 1967, and forthcoming).

The large amount of senior librarians' time needed for providing an inter-library loan (S,PILL) requires some explanation. The average time for providing a loan includes the time spent in writing that an item is unobtainable from this library and suggesting a source from which it might be obtained.

The relationships for Science are markedly different from those for Arts/Social Science. Books are more expensive, so the call on the uncommitted budget made by a book purchase is greater. On the other hand, scientists know what they want; this literature is better organised nationally and internationally, and many inter-library loan requests are for periodical articles which involve lower postage charges.

For the Science Library the table is as follows:-

2.8

	I	OILL	PILL	LML	LL	W	Xer	US	UM	UJ
S	0.05	0	0	0	0	0	0	1	0	0
M	0.33	0	0	0	0.01	0	0	0	1	0
J	0.31	0.2	0.4	0.003	0.12	0	0.5	0	0	1
C	0.197	0.2	0	0	0.008	0	0	0	0	0
£	3.78	0.15	0.24	0	0	0	-0.79	0	0	0
LLS	0	0	2	n	1	0	0	0	0	0
RS	0	0	0.10	n	0	0	0	0	0	0
St	0	0	0	1	0	1	0	0	0	0
Sh	0.1	0	0	0	0	0	0	0	0	0
Xer	n	0	n	0	0	0	0.5	0	0	0

Comparing the costs of book purchase and inter-library loan

The tables give the requirements for each of these activities. Over a period of a year it is possible to substitute one resource for another, so money costs become relevant.

Assume that the labour costs are as follows:

Senior librarians	£1.2 per man hour (m/h in table below)
Middle librarians	£0.8 " " "
Junior librarians	£0.4 " " "
Clerical	£0.4 " " "
Porters	£0.4 " " "

The relevant costings are:

Arts/Social Science

Purchase

S 1.2 m/h @ £1.2 = £1.44
J 0.3 m/h @ £0.4 = 0.12
C 0.3 m/h @ £0.4 = 0.12
P 0.03 m/h @ £0.4 = 0.01
£ purchase price of book 2.75
photocopying 0.03
£4.47

I.L.L.

0.07 m/h @ £1.2 = 0.08
1.2 m/h @ £0.4 = 0.48

0.2 m/h @ £0.4 = 0.08
postage 0.25

£0.89

For Arts/Social Science, purchasing a book costs about five times as much as borrowing it.

Science

Purchase		I.L.L.	
S 0.05 m/h @ £1.2 =	0.06		
M 0.33 m/h @ £0.8 =	0.26		
J 0.31 m/h @ £0.4 =	0.12	0.2 m/h @ £0.4 =	0.08
C 0.20 m/h @ £0.4 =	0.08	0.2 m/h @ £0.4 =	0.08
P 0.03 m/h @ £0.4 =	0.01		
£ purchase price of book	3.75	postage	0.15
photocopying	0.03	cost of form	0.08
	£4.31		£0.39

For Science, purchasing an item costs about eleven times as much as borrowing it.

These costings are different from the usual cost accountant's figures because overheads are not included (Brutcher et al, 1964). Allocating overheads is a waste of time unless they give information relevant to decisions: mostly the problem arises when management is considering what prices should be charged. Here the only relevant problem is the using up of shelf space. There comes a time when the next book purchased involves buying a new library to put it in.

Comments

1. If there were less variety between universities for routine operations, there would be a saving in highly skilled labour because the rules would be more widely known and centrally produced aids could be used. In a library with open access a finding list is essential, and a classification scheme enhances the value of the stock. At present, in many university libraries, considerable skill and judgment are required to ensure that the catalogues are maintained at the existing levels of accuracy and complexity, although, in general, it is not known how much or little information the users require from them. If less skilled labour were used on cataloguing with present methods, would the loss of benefit due to an increase in errors and inconsistencies in the catalogue outweigh the gain in benefit from having knowledgeable labour available for user services? If a simplified finding list were used, would the loss in benefit due to less information in the catalogue outweigh the gain from releasing labour for other uses? These questions require some bravery to answer, because many types of catalogue error are cumulative: the errors do not spoil just this year's entries, but those of all succeeding years as well. (For an approach to the problem that ignores some of the qualitative aspects, see Butterworth, 1969, pp 43-55.)

2. The woolly national organisation of Arts and Social Science literature means that an inter-

library loan costs over twice as much as for science. This woolliness accounts for part of the difference in demand for loans from academics. In the Arts/Social Science library one out of five ILL prove unobtainable, in the Science library only one out of 90.

3. The difference in cost between a purchase and a loan is £3.6 for Arts/Social Science and £3.9 for Science. If it seems to be the case that an academic is asking for a book to be purchased which will be used only once, then it is worth a librarian spending an hour trying to persuade him to borrow the book rather than buy it. The result would be more time for user-services, less call on the budget and a longer period before a new library becomes necessary.

4. If library users are aware of all costs and consider themselves responsible for them, their decisions imply that 11 loans are worth one purchase in Science, and five loans are worth one purchase in Arts/Social Science. We wonder about this, and pursue the line of reasoning in the next chapter.

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CHAPTER 3

MAXIMISING THE BENEFITS FROM EXISTING LIBRARY RESOURCES

The usual approach to information problems is to find out the needs of students/teachers/researchers and then attempt to provide for these needs as cheaply as possible. This has the merit of treating the present members of an organisation as the more important. It takes into account the fact that the reproduction of research findings is far cheaper than their production. In practice it does not work very well, partly because the needs are difficult to discover, but also for other reasons.

Most organisations, and universities in particular, are severely limited in their actions by decisions taken in the past. A university library has a building, a book-stock and a team of skilled workers. None of these resources can be changed significantly on a month-to-month basis. Of course, small re-arrangements to the building are possible; proportionately small additions to the collection of monographs and serials occur continuously; there may even be some change in staff. However, an expansion of students/teachers/researchers which necessitates a new library is a major top-level decision within the university. So is a change of fields of study large enough to render the existing bookstock useless. All this suggests that an alternative approach may be worthwhile. Instead of taking needs as given and finding how to meet these needs at minimum cost, we can take resources as given and find out how to maximise the benefit from these resources.

The "needs" approach requires a continuous re-arrangement of the fruits of the past to ease the research of the present. The "maximising" approach requires some adaptability by present researchers in order to gain from the fruits of the past. Perhaps the latter is equally realistic. If one is presented with an island of seagulls' droppings one can hold one's nose or one can find the nitrogen content, but the clever man will do both.

This chapter is about the "maximising" approach. It does not pretend that this is superior to the "needs" approach, but rather a complement of it. The "needs" approach is essential for long term planning; the "maximising" approach seems preferable for month-to-month planning and it yields some insights into the preferences of library users which may contribute to an understanding of their needs.

In Part I a library in fairyland is discussed in some detail. This unrealistic but simple example allows many of the principles of linear programming to be outlined, and some illustrations of the usefulness of the technique are given. The approach is seen to rely upon a knowledge of the relative importance of the different library activities and two methods of measuring this are proposed in Part II.

In Part III the method is used on a real example, the Arts/Social Science Library in the University of Durham. The implications of changes in users' preferences, or changes in the resources available, or changes in library technology can be assessed by a few seconds' time on a computer.

I A library in fairyland

This library engages in two activities: answering queries and lending books. There is no shortage of books and no shortage of space. The only resources that are scarce are three different sorts of labour: senior librarians, junior librarians and clerical labour. The problem facing the library is to decide how much of these two services it should provide each day, given that resources are limited. The library is motivated to find the best combination because it receives 7 shillings per query answered and 10 shillings per loan, and it wants to maximise profits. (The prices are an indicator of the strength of demand for the services. Where they came from is another matter! We can assume for the moment that there are many libraries competing with each other, but in Part II this assumption will turn out to be unnecessary.)

First the maximum amounts of queries and loans which the library could produce are found. This involves finding how much of each resource is available and how much of each resource is needed to produce one unit of each activity. There are 980 minutes of seniors' time available each day, and it takes 11 minutes of this to contribute to the answer to one query and 2 minutes to contribute to the provision of one loan. The constraint on library activities imposed by the shortage of senior librarians can be described as

$$11 Q + 2 L \leq 980$$

when the numbers refer to minutes of seniors' time, Q is the number of queries answered in a day, and L is the number of loans made. The total commitment must be less than or equal to the total available. Both junior librarians and clerks are also needed before the activities are completed, but the constraint imposed by only the shortage of seniors is illustrated in Figure 1. Any point outside the triangle is impossible because of the way the problem is defined. Any point inside is inefficient because with the relationship as given more could be produced. Only on the borders of the triangle is production both possible and technically efficient.

There are 400 minutes of juniors' time available each day; it takes 3 minutes of this time to contribute to answering a query and 5 minutes for a loan. There are 100 minutes of clerks' time available each day; it takes one minute of this to contribute to a query and one minute for a loan. All this can be summarised in Table 1.

Table 1

Resource	Amount needed per unit of Q	L	Amount available
Senior	11	2	980
Junior	3	5	400
Clerical	1	1	100

In Figure 2, the three constraints are shown. The border oabcd encloses the possible combinations of Q and L. This area, including its boundary, is the set of production possibilities. Points to the north-east of ab are impossible because there is not enough clerical labour, of bc because of insufficient junior labour, of cd because of insufficient senior minutes. Points west of oa and south of od are meaningless because negative quantities of Q and L are impossible.

Since the library receives 7 shillings for each query answered and 10 shillings for each loan, the total revenue will be 7Q + 10L. The next table shows the combinations of Q and L represented by the corners of the set of production possibilities (all numbers are rounded down) and the revenue which results from this combination.

	Q	L	Revenue
a	0	80	800
b	50	50	850
c	86	13	732
d	89	0	623

The economically efficient combination is at b, when the library answers 50 queries and provides 50 loans each day.

A change in demand

Suppose that the community served by the library now contains an increased number of technologists so that the demand for the query answering service increases. The prices of queries goes up to 11 shillings and the price of loans stays at 10 shillings. The library is now trying to maximise the revenue function 11Q + 10L. When Q = 50 and L = 50 the revenue increases from 7Q + 10L = 850 to 11Q + 10L = 1050 shillings. However the ratio of prices has now changed. When this happens the library hunts around for another blend of activities to see if a reduction in L and an increase in Q would be worthwhile. At c, in Figure 2, 11Q + 10L = 11(86) + 10(13) = 1076, so the new blend is more profitable at the new prices, and the new economically efficient combination is now at c, where the library answers 86 queries and provides 13 loans each day.

In Figures 3 and 4, the two revenue functions are illustrated. (These functions are known as objective functions.) Each function is a family of lines of equal slope, and the choice of which blend of activities to produce depends on the slope. Note that the slope depends on the ratio of prices rather than on the absolute prices. The price ratio shows how the community would be prepared to swap one activity for the other, and this is all that is needed in order to decide what blend of activities to produce from given resources. The total profit is useful in order to decide whether to expand or contract the library as a whole; it shows whether resources are better used in the library or rather in other organisations in the community. This difference between relatives and absolutes becomes very important when we descend from fairyland.

An increase in resources

An increase in clerical time available from 100 to 112 minutes a day allows the production possibilities to be increased to Q = 83 and L = 29. In Figure 5 the increased level of this resource is shown by the dotted line. At the point f all three types of labour are used fully, as shown by the meeting of the three lines. No type of labour is a bottleneck and none is idle. If trained labour could be hired easily, or if labour could be fired easily without leading to insecurity, this position could be achieved by trial and error. In practice many libraries do seem to be near this point except during a period following some major change.

A more flexible labour force

Both clerical workers and junior librarians require a short training period and a similar background of general education. If there were more flexibility between these two types of labour they could be considered as one type. In this case the two constraints could be merged into one constraint.

$$\left.\begin{array}{r} 3Q + 5L \leqq 400 \\ Q + L \leqq 100 \end{array}\right\} \text{ become } 4Q + 6L \leqq 500$$

Figure 6 shows the new single constraint as a dotted line replacing the two constraints, one for juniors and one for clerks. Provided production occurs at b, this increased flexibility does not allow any increase in production. However, as soon as demand conditions change so that a movement away from b is justified, the flexibility leads to a greater output than would be possible when the old division of labour applied. The dotted line is less constraining than the old ab, bc constraints except at the point b.

A change in technology

A new aid to information work allows a reduction in the amount of senior and junior librarians' time required to answer queries. If the innovation were adopted the seniors would need to spend only 9 minutes per query instead of the 11 needed at present; the juniors' time per query would be reduced from 3 minutes to 2. How can the effects of the aid be calculated to find out whether the innovation is profitable enough to justify the costs of adopting it?

The present set of production possibilites was given by:

$11Q + 2L \leqq 980$ minutes of senior librarians' time

$3Q + 5L \leqq 400$ minutes of junior librarians' time

$Q + L \leqq 100$ minutes of clerical time

If the new aid were adopted, the production possibilities would become:

$$9Q + 2L \leqq 980$$

$$2Q + 5L \leqq 400$$

$$Q + L \leqq 100$$

When the prices were 7 shillings for queries and 10 shillings for loans, the most profitable combination of activities was shown as point b, but at this point all of the time of the senior librarians was not used up. Therefore any further saving in senior librarians' time would be worthless.

However the saving in juniors' time would allow an increase in production. This increase would be very much more marked if the amount of clerical minutes available were increased at the same time that the innovation was adopted. Removing one bottleneck often creates another which in this case is far cheaper to remove.

The new aid becomes more profitable if the price of queries increases to 11 shillings, so it might be worth while adopting the innovation in anticipation of an increased number of library users who were technologists. The profitability of the innovation depends on which set of prices prevails and how much clerical labour is available.

In a situation where a number of different policy changes are possible, the various outcomes can be calculated and tabulated as in this example; shown in Table 2.

Table 2

Clerical time available	Prices in shillings		Old technique			New technique		
			Optimal blend		Revenue shillings	Optimal blend		Revenue shillings
	of Q	of L	Q	L		Q	L	
100	7	10	50	50	850	33	66	891
112	7	10	83	29	871	54	58	958
100	11	10	86	13	1076	100	0	1100
112	11	10	83	29	1203	108	4	1228

Obviously the revenue is greater the more the resources, the higher the prices and the more efficient the technique, but a knowledge of the direction of change is not enough. Only numbers can tell us whether the revenue is sufficiently greater to justify the cost of increasing the resources or adopting the new technique, and the numbers needed are those revenues which result from the optimal blend of activities. The optimal blend is found from the ratio of prices; the revenue is found from the cardinal value of each price, the money value of each unit of output.

It is the money value of each unit of output that will prove to be the problem in this chapter. Table 2 illustrates the sort of situation that could arise. The zero in the penultimate column shows that with certain price ratios no loans will be offered because there is more revenue to be had by devoting all resources to answering queries. When we descend from fairyland to the university we shall be dealing with a situation where most loans are provided by the main library. If the university library switched all resources from providing loans to answering queries there would be a clamour from users, but this is just to say that their idea of the value of loans given up is greater than the values of additional queries answered, and this happens because the price ratios would change as the quantities provided change. (In fairyland the mathematics are kept simple by assuming many alternative sources of supply for loans.) The examples in this part are given to show the many uses to which a linear programming approach can be put if the prices are known. Unfortunately the university is not a market economy and there are no prices, so the university cannot use quite the same methods of planning that were appropriate in fairyland. In Part II a way of assessing price ratios is given, and in Part III some ways of adapting the technique are suggested.

II Planning without actual prices

Let us suppose for the moment that we know the range of activities that the library could have produced; we know the actual blend that the library did produce, and we know that the library was economically efficient. Under these circumstances can we deduce the prices that must have been prevailing at the time?

In the terms of the example of Figure 2, if we know the production possibilities and if we observe that production occurs at b, can we deduce the prices? At least we know that if b is the economically efficient combination, then the slope of the objective function must be on or between the slope of the constraint ab and the slope of the constraint bc. Now ab is the junior librarian constraint, $3Q + 5L \leq 400$, whose downward slope is 3/5; and bc is the clerical constraint, $Q + L \leq 100$, whose slope is 1. Therefore the objective function has a slope of between 3/5 and 1. But this slope gives the price ratio. It tells us that if the price of a loan is one unit, then the price of a query answered is between 3/5 and 1 units.

Alternatively, we might observe that production occurs at c. This is where the clerical constraint bc meets the seniors constraint cd. The slope of the clerical constraint, $Q + L \leq 100$, is 1, and the slope of the seniors constraint, $11Q + 2L \leq 980$ is 11/2. The slope of the objective function must be between 1 and 11/2. So if the price of a loan is one unit the price of a query answered is between 1 and 11/2 units.

At least this method sets a limit to the range of price ratios. In some circumstances this range can be quite narrow and can give close approximations to the relative importance of the library activities. If a library is efficient, and if the formal and informal communication systems within a university are functioning properly, then observation of the library allows numbers to be put to the relative value of the various library activities. These numbers are relative rather than absolute, but they provide sufficient information to allow library planning to take place. (More complicated examples can be solved using trigonometric techniques.)

Most people seem to find the idea of swapping easier to understand than the idea of pricing, so discussion is more likely to be informative if it is conducted in terms of swap-rates rather than price-ratios. (A swap-rate is the inverse of a price-ratio. If the ratio of the price of Q to the price of L is 3/5 = 0.6, the users are prepared to swap 5/3 = 1.66 of Q for one of L, or about 17 for 10.)

In many cases the range of ratios is so large as to be unhelpful. This is particularly so in the example given in Part III because of the method of measuring the production possibilities which we have used. There are no complete figures available which give the relationships between resources and activities in "best", or "average" libraries, so we have taken the figures which we calculated for the sample library. Since most resources were not idle, the observed blend of activities looks similar to the point f in figure 5: most of the constraints go through the same point. But under these circumstances the range of ratios is at its greatest. An alternative approach will be shown to be more precise, although it does need more data.

Using economic theory to interpret past decisions

The university library is a major supplier of information services within the University. With any one of the services that the library supplies, the benefit will increase quite rapidly at first as the service passes the threshold of awareness of users and as the users come to feel able to rely on the service and assess it. If the service is expanded further the benefit from it will continue to increase, but less and less quickly. In some cases a service could be expanded to a level where users are over-loaded with information and the total benefit from the service actually decreases. The crucial variable is the benefit obtained from the last unit of the service, the marginal benefit (see Figure 7). Although crucial, this variable is not known. However, it can be imputed by examining the way in which costs are incurred in the library.

Over a period of a year or two the library has the opportunity to adjust the amount of many of the resources which it has available. In the previous section we had assumed that these were fixed because we were dealing with only short periods of time. The total of the resources will depend on the size of the budget, but the mix of resources will change as demand conditions change and call for changes in the blend of activities. Since the library knows the cost of these resources and has a fair idea of the amount of each resource that is needed to produce a unit of each activity, it also knows the cost of a unit of each activity. (In economic jargon, these costs are medium-run average variable costs and we assume here that they are close approximations to short run marginal costs. In cost accountancy terms, they are unit costs which do not include any allocation for overheads.)

An efficient library will adjust the blend of its activities in such a way that £1 worth of resources devoted to one activity could not give better value if it were devoted to another activity. If the library is trying to get the most from a limited budget, it will continue to expand a particular library activity until £1 of budget could be better spent on increasing another activity. But this is to say that the librarian (or rather the complex committee system that decides such matters) has an intuitive idea of the benefit to be obtained from the last unit of any activity that is provided. We are assuming that the marginal costs of, and the marginal benefits from, the activities of the library are known. (In Part III a test of these assumptions is given and they pass, so read on!)

Suppose that the marginal cost of activity x is ten times the marginal cost of activity y, and the librarian is allocating variable resources efficiently. In this case the librarian must judge that the last unit of activity x is worth, to the community served, ten times as much as the last unit of activity y. The ratio of marginal costs equals the ratio of marginal benefits. Writing MC for marginal costs, MB for marginal benefits, and subscripts x and y to denote the two activit ies:

$$\frac{MC_x}{MC_y} = \frac{MB_x}{MB_y}$$

Rearranging and generalising to more than two activities:

$$\frac{MB_x}{MC_x} = \frac{MB_y}{MC_y} \quad \cdots\cdots \quad \frac{MB_z}{MC_z} = k.$$

where k is some constant. So $MB_x = k.MC_x$ and the value of the last unit of each activity can be found by multiplying the marginal cost by k. (The theoretical problems involved in the concept of marginal benefit are discussed in Appendix 4.)

Because the library is a major supplier, the marginal benefits will change as the levels of the activities change. However, it is reasonable to assume that in most cases the change in marginal benefit will be small for small changes in activity levels. If we start by assuming that the marginal benefits stay constant, we can proceed with some useful analysis and then relax the assumption later.

Writing x, y, z as subscripts to denote which activity, and as variables to denote the level of the activity, we can compare two different blends of outputs by comparing two different numerical values of x, y, z in the following expression:

$$MB_x.x + MB_y. + \ldots.. + MB_z.z$$

which is the same expression as:

$$k.MC_x.x + k.MC_y.y + \ldots.. + k.MC_z.z$$

Therefore small changes in the blend of library activities can be assessed by using the expression:

$$MC_x.x + MC_y.y + \ldots.. + MC_z.z$$

since this is the objective function as used in Part I. The k can be omitted, because only the ratios are relevant.

The reasoning can be reversed. If the marginal costs are known, the ratio of marginal benefits can be imputed from these, and we can then describe how decision-takers seem to be valuing the library's activities.

III Application to the Durham Arts/Social Science Library

(See Appendix 6 for a description addressed to librarians.)

Assessing the relative importance of library activity

The choice of library activities to be considered depends on the sort of problems which are relevant to short-term planning. Our choice was influenced by problems such as: What is the relative importance of an inter-library loan compared with purchasing a book? How important are user-services compared with other activities?

The classification of activities must be done in a way that is mutually exclusive and allows quantification. It need not be exhaustive although the list below does cover the major activities at Durham. The choice of activities was governed by the following reasoning. The most expensive activity is increasing the stock. Compare this activity with others which are substitutes, particularly inter-library loans. Some activities complement these, so consider also the complementary activities of user-services. However, resources which are devoted to this group of activities may result in a reduction in the activities which are concerned with the actual use of the library's existing bookstock, so consider these also. The list gives those activities which were considered together with the units of measurement. The code letters are provided to aid cross-reference in the tables.

I Increasing the stock, measured in number of items added during the period considered (the 9 weeks of the Summer Term, 1968).

OILL Obtaining inter-library loans, number of items.

LML Providing library materials for consultation in the library, number of user-hours spent using library material.

LL Issuing items on long loan (2-week recall), number of items issued.

SL Issuing items on short loan (4-hour or overnight), number of items issued.

US Senior librarians giving advice to users, number of hours spent on this activity by senior librarians.

UJ Junior librarians helping users, number of hours spent by junior librarians on this activity.

For other problems a different or a more detailed classification of activities may be appropriate.

The resources which must be taken into consideration include all those which limit the expansion of library activities. One very peculiar omission from the list of resources is the bookstock. This is because we are considering as activities the various ways in which use can be made of the existing bookstock, combined with one activity for keeping the bookstock up to date. The list of resources is given below.

S Senior librarians, man-minutes available for the listed activities during the time period under consideration (9 weeks).

J Junior librarians, man-minutes

C Clerical staff, man-minutes

P Porters, man-minutes

The budget available for purchasing books, in shillings.

Seats, seat-hours, being the number of seats times the hours that the library is open.

3.12

Shelving, spare shelving, in feet.

The resources required per unit of each activity and the total resources available are given in Table 3, which is similar in lay-out to Table 1.

Table 3

	I	OILL	LML	LL	SL	US	UJ	Resource available
S	72	4	0	0.6	0	60	0	2208 x 60
J	18	72	0.4	5	3	0	60	2364 x 60
C	18	0	0	0	0	0	0	460 x 60
P	2	12	0.1	0.1	0	0	0	233 x 60
Budget	56	5	0	0	0	0	0	4315 x 20
Seats	0	0	1	0	1	0	0	83600
Shelving	0.1	0	0	0	0	0	0	14000

Table 3 yields most of the information needed to calculate the marginal costs. In practice only the budget and the various types of labour can be varied in the medium run. A decision markedly to increase the number of seats or shelves involves building a new library and is therefore a long-term decision. Since the budget is already measured in money terms, only the different hourly labour costs need to be found in order to calculate the marginal costs of the different activities. However, Table 3 does not given even an approximate picture of the production possibilities of the library. In mathematical terms, each column represents a variable; the rows could represent an equation, but only if all the resource is used up during the period. In practice the last two rows are not equations but inequalities. This shows us that the problem is not yet properly defined.

There are a number of additional constraints which in practice are limiting the production possibilities of the library. The various resources may be more limiting than our figures show. Senior librarians may be more specialised than our classification has allowed: some are cataloguers, some specialise in user-services, and it may be difficult to change from job to job. If all the shelving were to be used up during this period there would have to be a new library at the beginning of the next period if new stock were to continue to be brought in; but the amount of shelving available during the present period depends on the investment plans of the university, which depend in turn on the metaphysics of the U.G.C.

Apart from the resource constraints there are also demand constraints. The library may be able to provide more of certain activities but the relatively small population of users may not want such activities beyond a certain level. In an institution which engages in teaching and research the fact that users do not want certain activities beyond a certain level is not the same as saying that the marginal benefit of these activities is zero, because the marginal benefit is an assessment made on behalf of the institution as a whole and not by individual users for themselves. Most of us feel that everyone else should use the library more.

In order to postpone consideration of these difficulties but also to convey the impression that certain activities of the library are so important that they must be made available in all circumstances, we impose three demand constraints on the problem. These state that the number of long loans (LL) and short loans (SL), and the number of hours spent by users using library material in the library (LML) must be greater than or equal to the levels which actually occurred during the period. This completes the set of production possibilities.

Note that our problem at the moment is to find measures of the relative importance of library activities. To do this the actual levels of these activities are data. It is only after we have these measures that we can plan ahead to find the effects of changing the levels. Therefore it is not tautologous to take what actually occurred and deduce from this the measures of relative importance.

Table 4 gives in the first row the marginal costs in shillings of the activities. The method of calculating these costs is given in Chapter 2, and the theoretical implications are discussed in Appendix 4. (We used 8.8 shillings for the hourly rate for juniors, 10% higher than the actual rate because all the symptoms of a wage rate below equilibrium were present, and librarians were treating the cost of juniors' labour at what they expected it to be in the near future.) The second row gives the levels of the activities that would be predicted by using the marginal costs as the weights in the objective function (these weights are used in the same way that the prices were used in Part I); this is a calculation performed by the computer. The third row gives the observed levels that the library did produce.

Table 4

	I	OILL	LML	LL	SL	US	UJ
Marginal cost	89.4	17.8	.064	.896	.40	24	8.8
Predicted level	1533	209	57,567	15000	1000	203	57
Actual level	1533	244	53,700	15000	1000	205	40

As a first approximation this is reasonable. It seems that an intuitive idea of marginal costs could influence librarians in the way they allocate resources. Unfortunately we were particularly interested in comparing the values of additions to stock (I) with inter-library loans (OILL) and the difference between predicted and actual is marked here.

Table 5 shows the weights on the objective function which result in the calculations yielding the same levels of activities as the observed levels. In the second row of Table 5 these same weights are expressed in terms of the value which is placed on one hour of a senior librarian's time. The ratios of the first and second rows are the same, and either row would yield the same result when used in the calculations.

Using the "swap-rate" method outlined in Part II, the third row of Table 5 expresses the information of the other rows in terms of the number of units of each activity that the organisation is prepared to swap for one addition to the stock. For example, the figures under I and US imply that if the university were presented with a choice between one addition to stock and four hours of skilled user-services, it would choose the reader services; if the choice were between one addition to stock and three hours of user-services it would choose the addition to stock; a choice between one addition and 3.4 hours would leave the university indifferent. The comparison between I and LML will be particularly interesting to the teacher.

Table 5

	I	OILL	LML	LL	SL	US	UJ
Weighting	81.0	17.8	.064	.896	.40	24	8.8
Value, taking one unit of US as unity	3.4	0.74	.0027	.037	.017	1	.37
Swap-rate in terms of one unit of I	1	4.5	1270	90	203	3.4	9

Table 5 gives different ways of comparing the values of the library's activities, values to the university which have been obtained by studying the actual results of the decisions taken by the system of committees. A first approximation to the figures was found by using the marginal costs of the activities, but the figures given in the table are not costs: they are figures showing the implied relative benefits of the activities. Strictly, we should state that the library is behaving as if these are the relative benefits of the activities. Certainly we should take any opportunity to check the conclusions with the decision-makers concerned.

So far we have been involved in the measurement of output, production relations, and the relative importance of activities. For this last a technique had to be developed to make explicit what previously had been left implicit, but we emphasize that we have only been measuring, not explaining or prescribing. Of what use are these measurements for estimating the effects of library decisions? In the final sections of this chapter they are used to show the implications of adopting an innovation and to suggest which resources of the library should be increased if expansion is necessary. The next section suggests some reasons why the weights might be changed.

The Relative Importance of Library Activities

It is extremely difficult to judge ex ante the relative worth of different information services. The difficulty becomes greater when the service caters for a small organisation because many of the demands placed upon it appear to be too random for decision-takers to form clear expectations of the value of the service. For this reason we have taken the backwards approach of finding out what people do and drawing inferences from this about (people's opinions on) the relative values of the different services.

In this chapter we have studied seven different services. Any one of these can be compared with another, giving twenty-one possible pairs. To ask people how and why they prefer one member of a pair to the other would be a formidable task, would stretch the patience and interest of library users to breaking point, and might yield very different results if repeated. Nevertheless, participants in a committee system do have to make decisions such as these continuously. One of the reasons why their mistakes are so often forgiven is that they relieve others of the cost of decision-taking.

We give below a few examples of the type of reasoning which might occur when different library activities are being compared. The pairs of library activities can be divided into two broad categories, complements and substitutes. For complementary pairs, one enhances the value of the other. For substitutable pairs, one could replace the other although they are not necessarily perfect substitutes; one may be of less value per unit than the other but substitution may allow so many more units to be produced that the total value is greater. Substitution should not be interpreted as sacrificing quality on the altar of cheapness.

In Table 6, the pairs of activities are shown. "S" suggests strong substitutability, "s" weak substitutability, and "C" complementarity.

Table 6

	I	OILL	LML	LL	SL	US
OILL	S					
LML	C	—				
LL	C	—	S			
SL	C	—	S	S		
US	C	C, S	C, S	—	—	
UJ	—	—	C	C	C	s

Purchase or borrow? One would expect that increasing emphasis will be placed on borrowing rather than purchase, as book prices increase and as the national lending facilities improve. Generally the emphasis will depend on the experience of many individual users. In each case the decision rests on a number of factors:

1. Is the title both purchasable and borrowable?

2. What are the comparative costs? A book purchase is more expensive both in the amount of budget and senior librarians' time. Using simple costings a purchase costs £4.5 compared with £0.9 for a loan, but these are average figures and individual items will vary around this mean. If a typical book is expected to be used more than five times during the planning period, then purchasing is apparently cheaper than borrowing, but this ignores the cost of housing the book. The appropriate planning period for a decision of this type would be five years rather than the two-year period we have used for some other decisions. The short two-year period is forced on the library by lack of estimates on the future, but a quinquennium is more suitable when possible.

3. What are the delay costs to the user? For physical scientists the two-day delay in obtaining a loan from the National Lending Library may be too long, but some users may feel that a wait of months before a loan arrives via the regional system is quite satisfactory. Because of the costs to users incurred by delay, a purchasing policy has to anticipate the needs of users to some extent. (For the dangers of attempting to anticipate these needs entirely, see Appendix 2.)

4. Is there a third choice? Often the cheapest and most fruitful solution will be to finance the user on a trip to another library.

In Table 6 the C's in the first column remind us that future use of the library (LML, SL, LL) depends on the present purchasing policy, and that liaison between users and senior librarians (US) will improve a purchasing policy.

Long loan, short loan, or confined books? We have not studied loan policies in this project. (For easily applied decision rules, see M.K. Buckland and A. Hindle, "Loan Policies, Duplication and Availability" in: Lancaster Seminar on Planning Library Services. Lancaster University Library. In Press, expected September 1969.)

Senior or junior librarians? User-services, whether from senior or junior librarians, will enhance the value of the other activities of the library. Information services by senior librarians can reduce the emphasis placed on some of the activities of the library (see Chapter 7). At the time the survey of library resources was carried out there were no Senior Library Assistants in the Arts/Social Science library. In pay and qualifications this category of labour comes between what we have called "senior" and "junior" librarians. Because of the large gaps in qualifications between seniors and juniors there is only weak substitutability between them. This weakness is enhanced because the wage scale of juniors is below the equilibrium, and the resulting high turnover does not allow them to develop a detailed knowledge of the workings of the library. Employing in addition the more adaptable grade of Senior Library Assistant allows a greater degree of substitutability between different types of labour, and this would be reflected in the evaluation of user services. A new activity could be introduced, user services from "middle" librarian (UM), and the values of US, UM and UJ could be compared.

The value placed on one particular activity depends on the levels of other activities. Decisions will be based on judgment of the needs of the particular library at the particular stage of its expansion. There are no rules which are applicable to libraries in general. However, the methods given here show how the many facts and opinions which increase or reduce the evaluation of the activities can be marshalled into a coherent and discussable argument.

Changing the technology

At the moment of writing, Newcastle University is developing a method of automating the ordering and accessioning procedure (inevitably, cataloguing and classification remain traditional). The new method will reduce the amount of labour required for the activity "increasing the bookstock" (I). We guess that the amount of senior librarians' time needed will be reduced from 72 minutes per item to 60; junior librarians' time will be reduced from 18 minutes to 9; clerical workers' time will be reduced from 18 minutes to 6. What would be the effects of introducing this innovation?

The first reaction to such a proposed improvement in library technique is to assume that a greater increase in the bookstock will be possible than is the case at the moment. However, the library is not only constrained by labour but also by the budget available for buying the books. The production possibilities are similar to those shown in Figure 5 at the point f: removing one constraint on expansion leaves others which are equally constraining. The problem is to know which resources to expand in order to make the best use of the innovation.

One alternative to expanding the resources would be to increase the flexibility of the labour force by giving similar training to juniors and clerks. An easier method is to assume that hiring and firing of juniors, clerks and porters are relatively simple and to give to the librarian discretion to spend the budget on both books and non-graduate labour. This means that the budget is raised, but not the cost to the university. Each activity that previously used up the resources of juniors', clerks' and porters' time now uses up a proportion of the budget, the precise proportion determined by the hourly cost of these different types of labour.

Table 7 sets out the proposed changes. In column two the present resource requirements for one unit of I are shown. In column three the requirements are shown if the innovation were to be adopted. Column four shows the new requirements when the different types of non-graduate labour are treated as a straight cost.

Table 7

Column one	Column two Present requirement	Column three Post innovation requirement	Column four Non-graduate labour as a money cost
Seniors' time	72	60	60
Juniors' time	18	9	
Clerks' time	18	6	
Porters' time	1.8	1.8	
Budget	55.6	55.6	57.4

Assuming that all the activities except increasing the bookstock (I), user-services by senior librarians (US) and by junior librarians (UJ) must be at least at the level they were at before, and assuming that the relative importance of the different activities stays the same (see Table 5), the new techniques yield the increases in levels of output as shown in Table 8.

Table 8

	I	OILL	LML	LL	SL	US	UJ
Before	1533	244	5[illegible]700	15000	1000	205	40
After	1533	638	53,700	15000	1000	483	35

The benefit from the innovation consists of an increase of 394 inter-library loans and 278 hours of user-services from graduate librarians. Of course, the gain in practice is in the capacity to provide these services: users still have to want to use them. Under the old technique these additional services would have incurred short-run costs of 394(0.9) + 274(1.2) = £688. Remember that the period to which this model refers is one term of nine weeks, so during a quinquennium the saving would be well over £10,000. More accurate costing would be necessary if the costs of adopting the innovation were of the same order of magnitude.

If the calculations show that a change of plan results in an obvious improvement, the blend of activities recommended provides a convenient method of planning the allocation of staff within the library. A new version of Table 3 is prepared which takes into account the changed technology, and staff are allocated according to the blend of activities which are to be produced.

3.20

Increasing the Resources

What additional benefit results from an increase in a particular resource? If a resource is not fully used up there will be no additional benefit from increasing it, just more of it will be idle. If a resource is constraining expansion, its increase can have a variety of different effects because of the complicated interaction between resources and activities. In a commercial situation the additional revenue that would result from an increase in a resource can be assessed and compared with the cost of increasing the resource (as shown in Part I). For our library there is no revenue, but there is a figure which gives an index of total benefit.

It will be remembered that the objective function described in Part II was weighted by the marginal costs of the activities, and these weights allowed the ratios of the unit values of the activities to be found. If we interpret each weight as an index of the value of that particular activity, we are using the same type of index for each activity so we can sum them to obtain an index for the total benefit of the activities.

The units of this index should not be interpreted as £s. In practice the index will give a number considerably less than the value in £s which the university is placing on the activities. (In the final chapter of this report we suggest that the index gives an amount which is between 24% and 60% of the university's valuation in £s of the output of the library, depending on the value which the university places on an hour of a graduate's time.)

The index is used in Table 9 to provide a basis of comparison of the value of additional output which would result from an increase of a resource by one unit. Where the resource is not scarce the figure is zero. For this table the units of resources are measured in hours and £s since these are more appropriate units for visualising an increase in the resources (in other tables in this part the units were minutes and shillings).

Table 9

Resource	Cost per unit of resource £s	Index of additional benefits	
		Present technology	Post innovation
Seniors' time (hrs)	1.2	1.2	1.2
Juniors' time (hrs)	0.44	0.44	
Clerical time (hrs)	0.4	0	
Porters' time (hrs)	0.4	0.24	
Budget (£s)	1	0.89	1.44
Seats (seat-hours)	high	0	0
Shelves (feet)	very high	0	0

The second column of figures shows the index of additional benefit resulting from an increase in the corresponding resource by one unit, with the present technology. Senior and junior librarians' time will be used in an activity which will raise the index by 1.2 and 0.44 respectively. The increased resources will go into US and UJ in this case, hence the rise in the index by this amount (See Table 5, row 1, where 24/- = £1.2 and 8.8/- = £0.44).

Clerical workers are shown as not scarce, but a calculation shows that there is only one hour of clerical labour unused. Our observations are not accurate to the nearest hour so we can only conclude that clerical labour is about right at the moment.

A comparison along the rows shows that the increase in the benefit index for the present technology is nowhere greater than the cost of increasing the resource by one unit. This implies that an increase of any one resource by itself would result in less increase in benefit than an increase in several resources simultaneously (we are at a position like point f in Figure 5). The final column shows that a different situation prevails if the new technique is adopted. Here an expenditure of £1.2 on senior librarians raises the index by 1.2, but an increase in the budget of £1 raises the index by 1.44. There is a greater proportionate pay-off from increasing the budget than from increasing seniors' time.

The amount of slack seating available works out at 2900 seat-hours for the nine-week period. When the expansion of library activities reaches the stage where it is limited by this resource, the particular activity which uses seats (LML) will not be able to expand further. In Chapter 2, the activity of working in the library without using library materials was mentioned. The amount of seating available for the activities mentioned in the present analysis is the amount left over after the requirements of those who use the library merely as a place to work have been met. If a shortage of seats develops, alternative arrangements for these users would seem to be the least costly method of expanding the number of seats available for those wanting to work with library materials.

The amount of space shelving available is 13,850 feet. Provision of additional shelving may be made by introducing a rigorous weeding policy or by expanding the library building. Both are expensive, but the latter particularly so.

Summary

1. Find the set of production possibilities of the library. Since the library is the major supplier of information services, some demand

constraints will be necessary in addition to the resource constraints.

2. Use the cost of those resources which can be varied over a one or two year period to calculate the marginal costs. Use the marginal costs of the activities as a first approximation to the weights in the objective function. Adjust these weights until the objective function, together with the set of production possibilities, yields a linear programming solution that is the same as the actual blend of activities produced during the period. (This adjustment is simple if the print-out contains information on upper and lower bounds to the weights.) The calculation makes the implicit objective function explicit.

3. Translate these weights into swap-rates and check with the decision-takers.

4. Use these weights to predict and compare the outcomes of possible changes in library policy and techniques.

Obviously this method of library planning has a number of disadvantages. It involves concepts with which many librarians will be unfamiliar. The numerical approach to comparative benefits, or the relative importance of library activities, implies an accuracy which is not there, and the value of approximation is often least appreciated by those who are unfamiliar with quantitative techniques.

However, a first attempt to find measures of relative importance is necessarily approximate and further experience can increase the accuracy of the estimates. The computer print-out (using Mathematical Programming System) contains a large amount of information additional to that mentioned in this paper, and this shows where the range of values is wide.

All the data required for this approach are needed anyway for elementary library management problems: the time taken by a particular type of labour to do a particular job, the cost of a unit of a particular activity, the amount of the various resources which are available.

The method allows library problems to be tackled one at a time, but without losing sight of the whole complex of library operations and the objectives of the library.

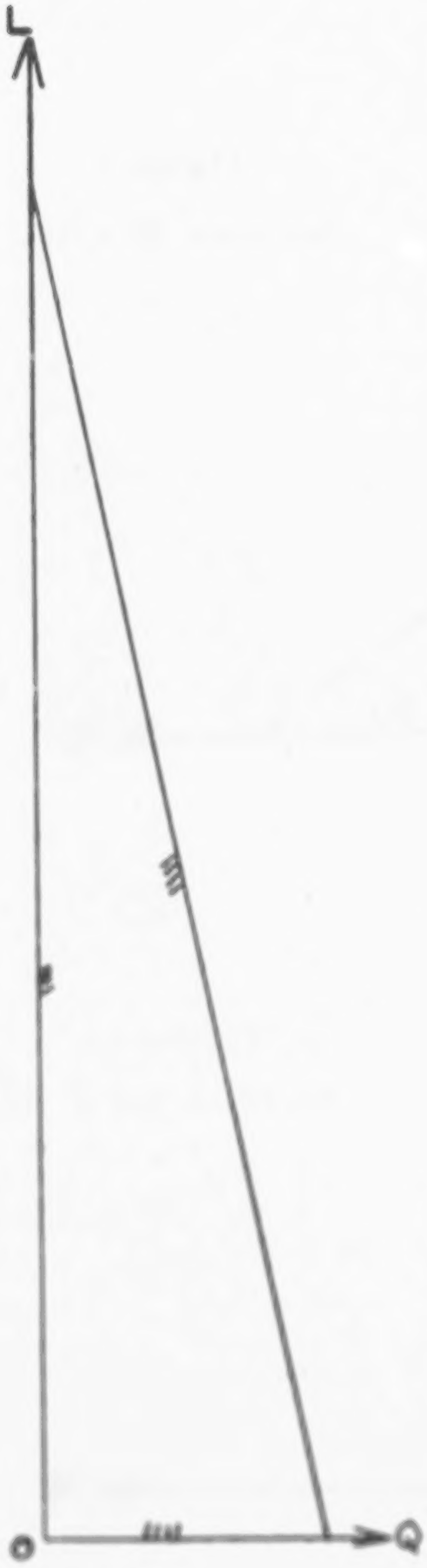

Figure 1

$$\begin{aligned} 11Q + 2L &\leq 980 \\ Q &\geq 0 \\ L &\geq 0 \end{aligned}$$

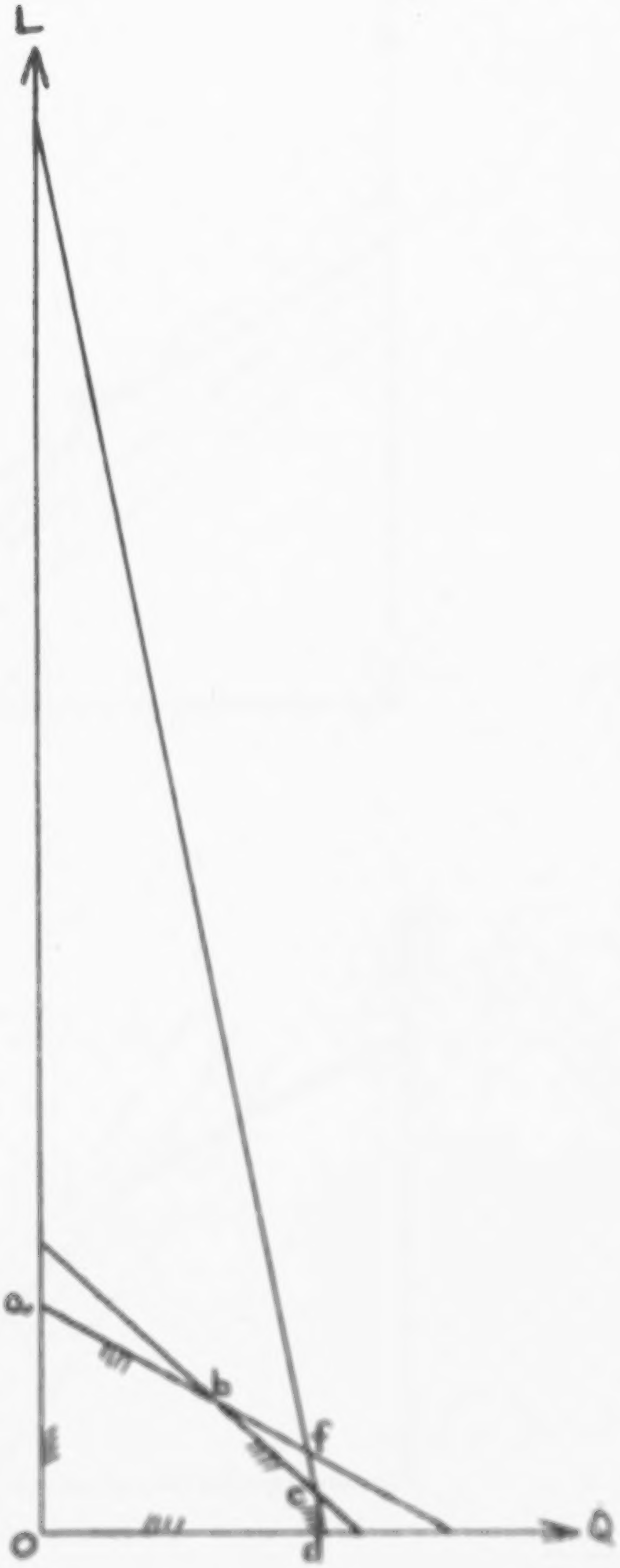

Figure 2

$$\begin{aligned} 11Q + 2L &\leq 980 \\ 3Q + 5L &\leq 400 \\ Q + L &\leq 100 \\ Q &\geq 0 \\ L &\geq 0 \end{aligned}$$

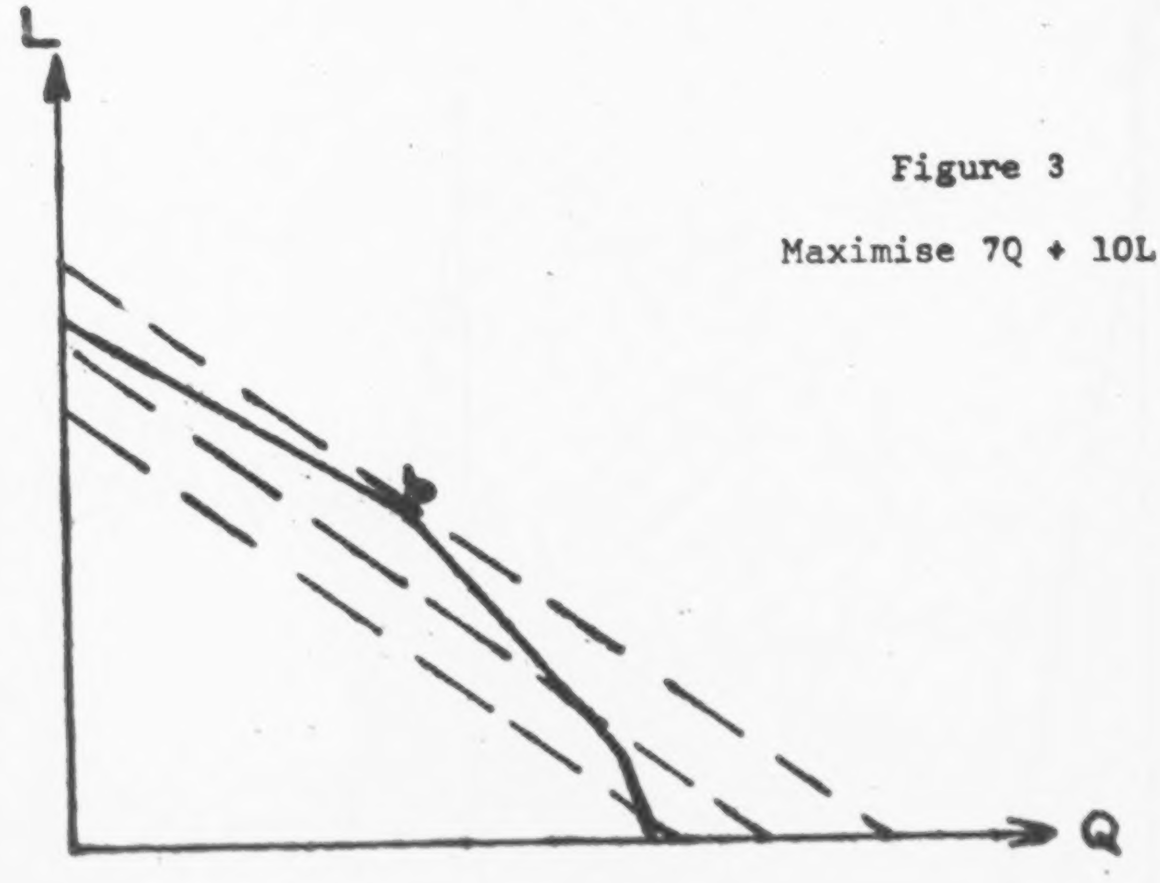

Figure 3

Maximise 7Q + 10L

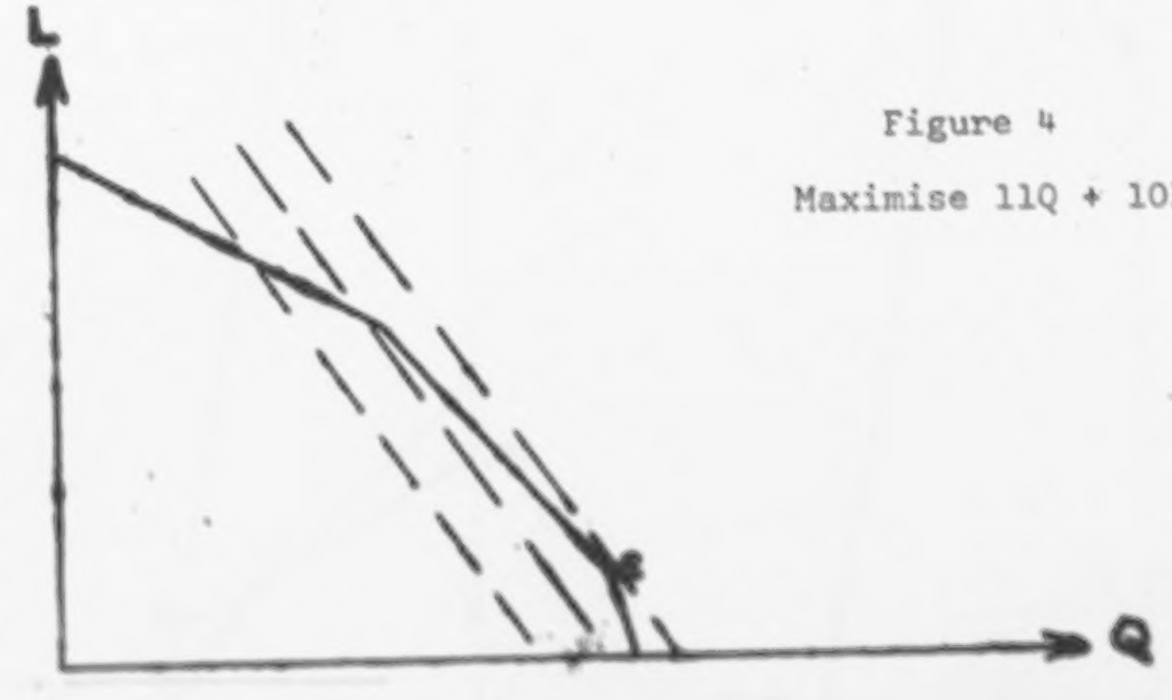

Figure 4

Maximise 11Q + 10L

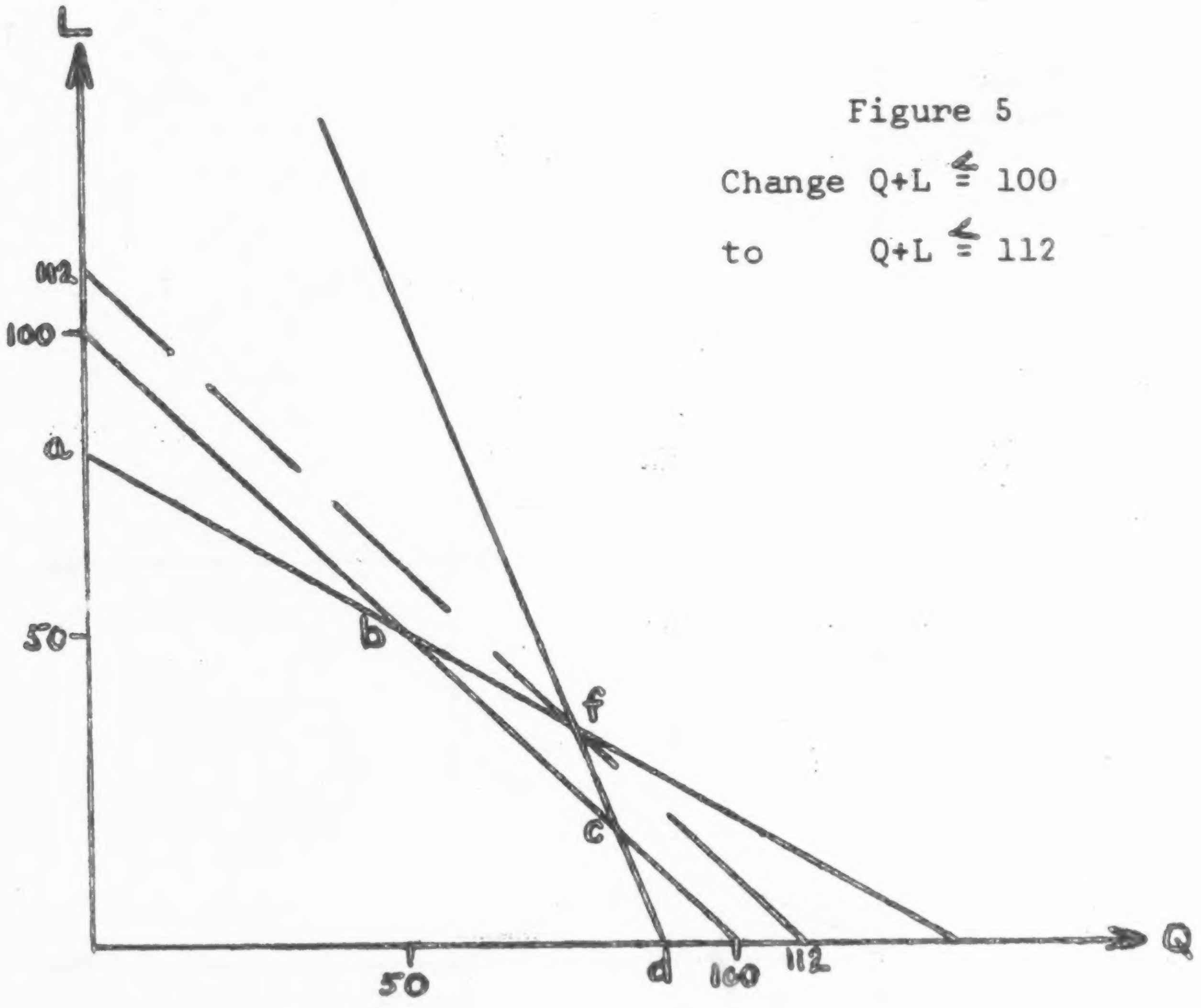

Figure 5

Change Q+L $\leq$ 100

to Q+L $\leq$ 112

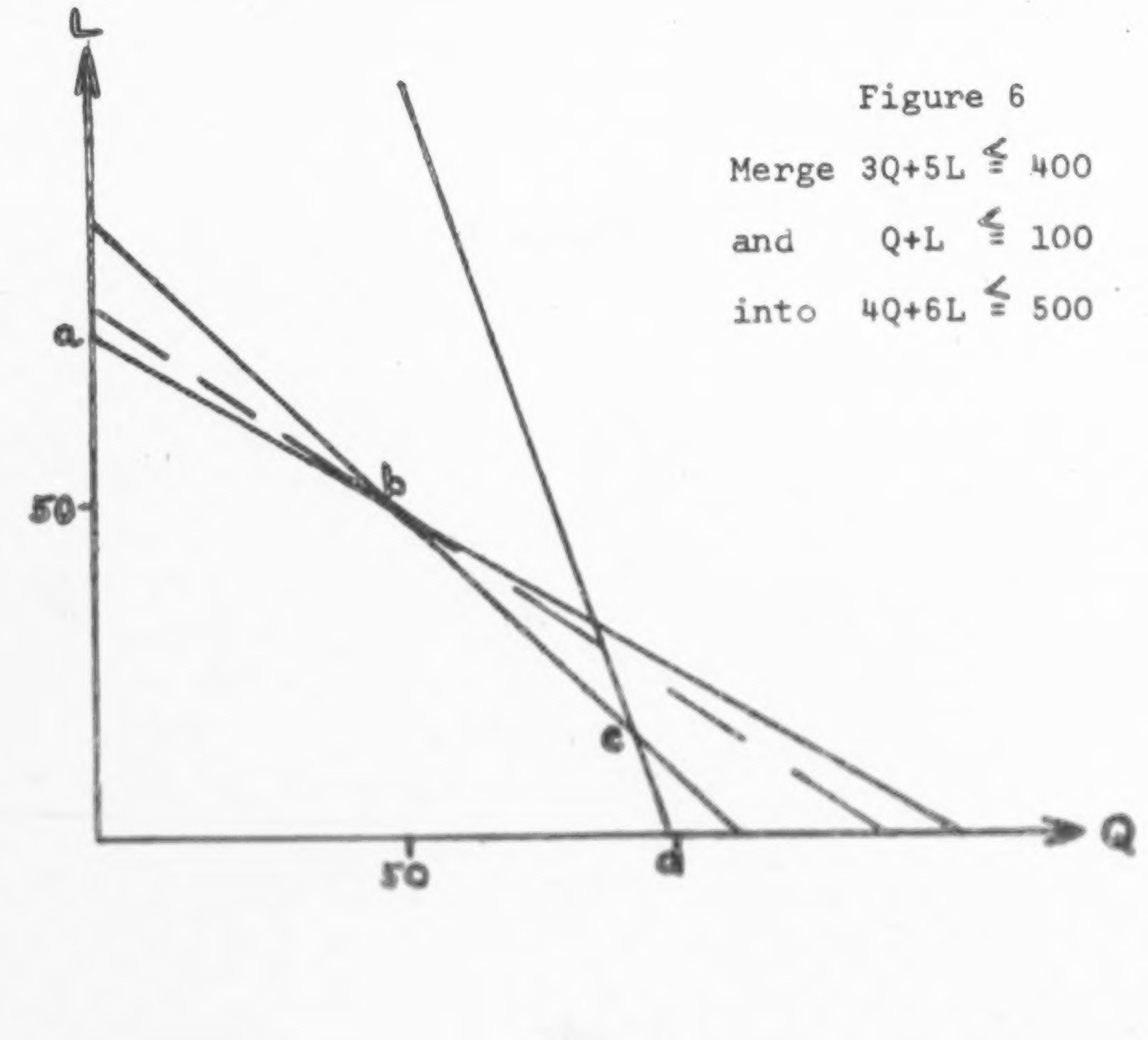

Figure 6

Merge 3Q+5L $\leq$ 400

and Q+L $\leq$ 100

into 4Q+6L $\leq$ 500

3.26

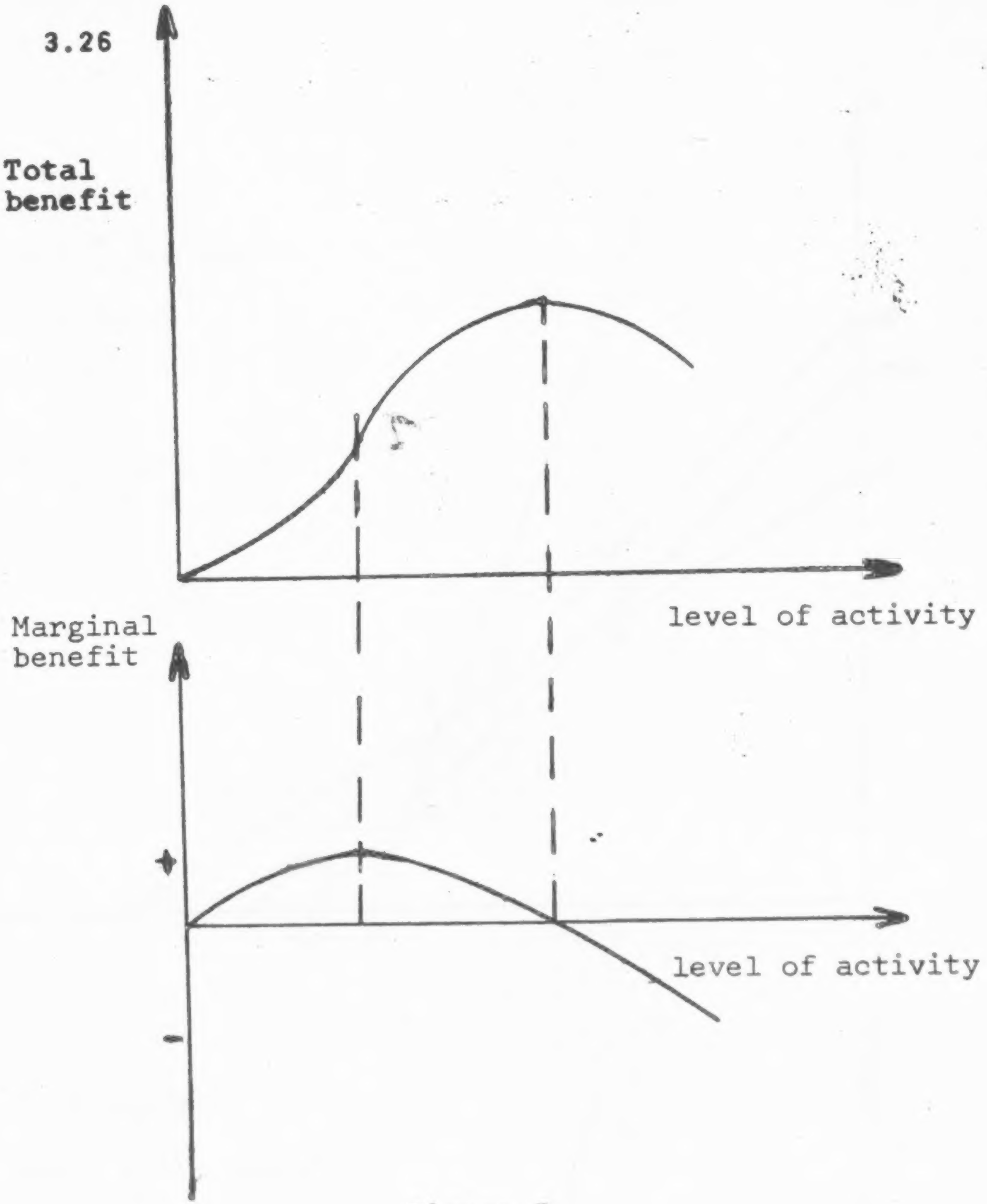
Total benefit
level of activity
Marginal benefit
+
-
level of activity

Figure 7

CHAPTER 4

SIMULATION OF LIBRARY USER'S DECISION PROCESSES

In the two preceding chapters we have been concerned with the library manager's view of benefits and costs of libraries, and with the development of a model to aid him in making decisions about medium-term resource allocations. We believe that he already implicitly takes into account the benefits and costs to the user, but that further information about these would be of use to him both as a complement to the linear programming approach for the medium term and as an essential feature of longer-term planning for which simple extrapolations of current demand statistics are not sufficient indication of likely trends. The model described in this chapter is a prototype for the benefit and user-cost part of a long-term planning model which we intend to develop, as outlined in Chapter 10; it will also be applicable in shorter-term studies.

The model has been constructed in accordance with some modern psychological views of choice and learning processes* which view the probability that an individual will make a certain choice as being determined by his current subjective estimate of its utility to him relative to that of other alternatives, the current estimate being in part determined by conditioning through past experience and part by the urgency of the target towards which he is working when making the choice. We describe the model in terms of the choice by an undergraduate between working in the library, the department or the college; exactly the same principles would apply for any type of individual making any type of quasi-rational choice.

Model situation

We imagine that our undergraduate has a timetable of lectures, meals, etc., which determines certain fixed places and times in his daily itinerary and schedule, and that he allocates the remainder

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The model has been constructed in accordance with some modern psychological views of choice and learning processes* which view the probability that an individual will make a certain choice as being determined by his current subjective estimate of its utility to him relative to that of other alternatives, the current estimate being in part determined by conditioning through past experience and part by the urgency of the target towards which he is working when making the choice. We describe the model in terms of the choice by an undergraduate between working in the library, the department or the college; exactly the same principles would apply for any type of individual making any type of quasi-rational choice.

Model situation

We imagine that our undergraduate has a timetable of lectures, meals, etc., which determines certain fixed places and times in his daily itinerary and schedule, and that he allocates the remainder of his time between work, recreation and sleep according to the urgency of the various demands upon it. We may regard the decisions about the timetable and about the overall allocation of untimetabled hours as being made respectively each term and each week; our model takes these decisions as given, and examines more closely his decision each day about where to spend the hours he has allocated to "work", supposing that there are only three possible alternatives: the college where he sleeps and eats, the department where his lectures are given, and the library. No distinction is made between different subjects or types of work for this simple version of the model; though there is no difficulty in making such distinctions, the description is simpler without them. The benefit measure that we suppose to lie behind the decisions is related to the number of units of work that he expects to do in each place in the time available, which may not be the same for each place because of differences in journey times and in "settling-down" times. We do not need to define "unit of work", as this is only an intermediate non-operational concept which, when multiplied by the "utility per work-unit" determined by the weekly priority decisions and adjusted for average expected waste of time, will yield the "subjective expected utility" actually determining the choice probability. It will be the subjective expected utility (SEU) of work in each place which we derive from inversion of the model, using data about actual undergraduate behaviour.

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* As expounded, for example, in:

"Handbook of Mathematical Psychology", edited by Luce, Bush & Galanter (Wiley 1963)
"Decision Making", edited by Ward and Tversky (Penguin 1967)
"Textbook of Elementary Psychology", Galanter (Holden Day 1966)

Simple example

Suppose the undergraduate has already decided to do three hours untimetabled work on a certain day, and he is in process of deciding where to do it, and suppose for the moment that his decision will be determined with certainty by the relative SEU values of the three possible workplaces: he will choose the workplace with the highest SEU value. The unconscious computation of SEU values might be like this: "the rates of working I expect to achieve in college, department and library respectively are 20, 30 and 50 units per hour; I would not waste any time going to the college or the department because I have to go there anyway for meals and lectures, but I would waste half an hour getting to the library and settling down to work; as work has a utility to me this week of 10 utility-units per work-unit, the SEU values are 20x3x10 = 600, 30x3x10 = 900 and 50 x2.5x10 = 1250 for the total periods available in college, department and library." With the resulting values, a wholly rational and deterministic choice must be to work in the library that day.

Now suppose that he fails to get the expected amount of work done in the library that day - his rate of working turns out to be 40 units per hour and he wastes one hour instead of half an hour - this experience will condition his SEU value for next time, making it 40x2x10 = 800 if he lets his estimate depend entirely on this most recent experience. The same options next day would therefore result in the choice of the department, with its SEU value of 900, as workplace. His choice has been biassed away from the library by one unlucky experience, and he may never go there again, however high his potential productivity there may really be.

We want to invert the model, so that the unknown SEU values can be deduced from actual behaviour. One or two decisions, as discussed above, are not a sufficient basis for an inversion, but if we observed the behaviour of a whole class of 100 undergraduates making decisions in similar circumstances we could make some statements about their implicit SEU values. If we found, for example, that 50 of them chose to work in the library while 50 chose to work in the department, we could say confidently that the average SEU values for library and department were too close to be discriminated, and that the average SEU value for the college was lower. A probability analysis would enable us to make such statements more precisely, as shown below; but the point to note here is that inversion of a reliable model calibrated by actual observations can lead to conclusions about implicit criteria. The difficult part of the operation is to ensure the reliability of the model!

Decision between alternatives with given utility values

Now we drop the temporary assumption of complete rationality; the rule we actually adopt for choice between two alternatives with subjective expected utility values a and b (where $a>b$) reflects the fact that people do not always choose consistently. If they did, we could be sure that a would always be chosen, but we assume a stochastic choice such that the choice of a becomes more likely as $a-b$ becomes larger. We also assume a discrimination threshold below which a and b cannot be distinguished. The exact rule used in the computer trial runs was that the probability of choosing a is a step-function $f(a-b)$ of the form:

$$f(a-b) = \begin{cases} 0.5 & \text{for } 0 \leq a-b < 20 \\ 0.75 & \text{for } 20 \leq a-b < 80 \\ 0.95 & \text{for } a-b \geq 80 \end{cases}$$

A diagram of the function is shown in Fig. 1; the numerical parameters can be changed, except that f must be a function increasing from 0.5 to (less than) 1 as its argument increases from 0 to infinity.

Choice between more than two options can be handled by simple extensions of this rule: in our model there is always a finite probability of choosing any of the three places of work whatever the SEU values, and if the three are not discriminated there is an equal probability of choice for each.

4.4

Fig. 1

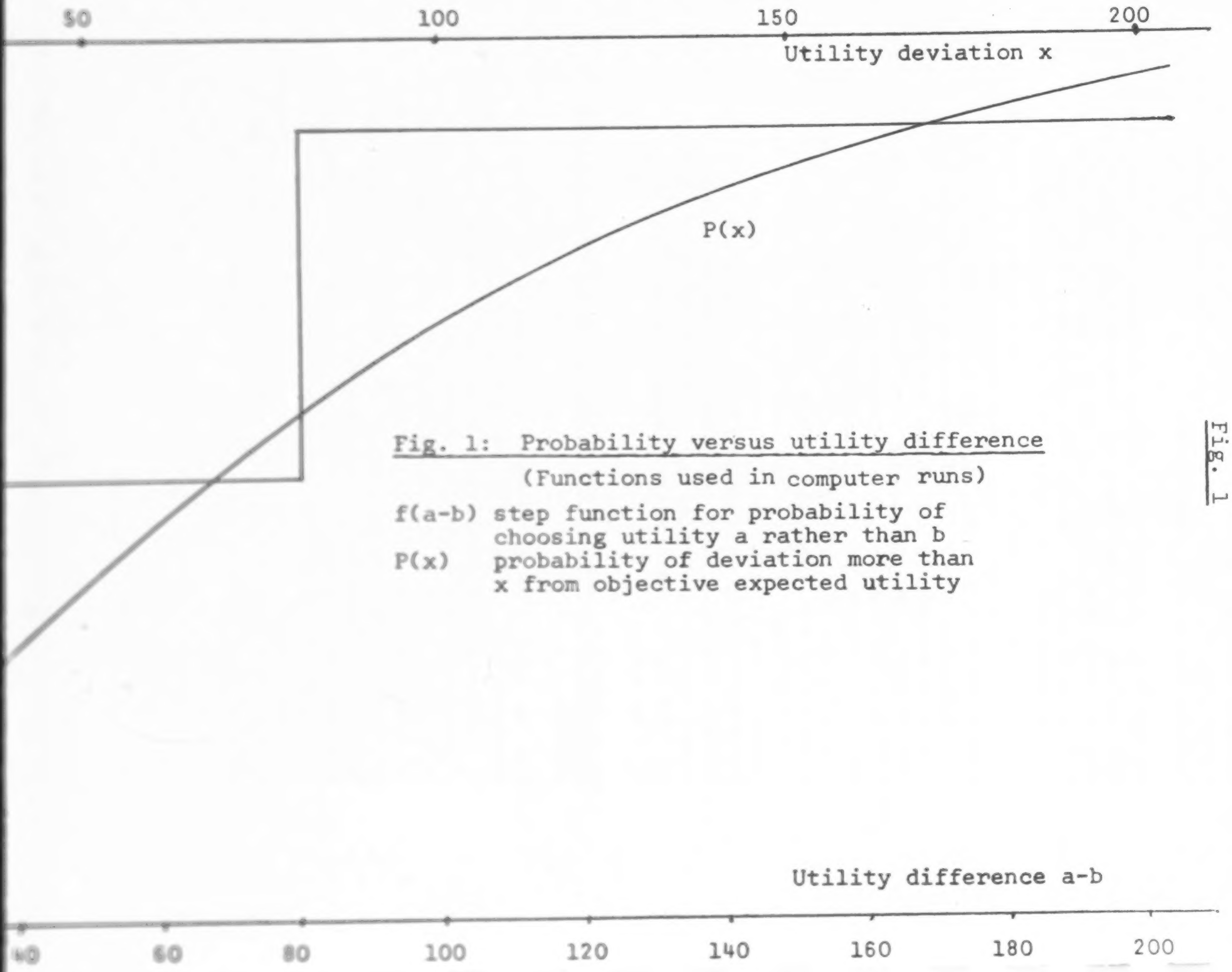

Fig. 1: Probability versus utility difference

(Functions used in computer runs)

f(a-b) step function for probability of choosing utility a rather than b
P(x) probability of deviation more than x from objective expected utility

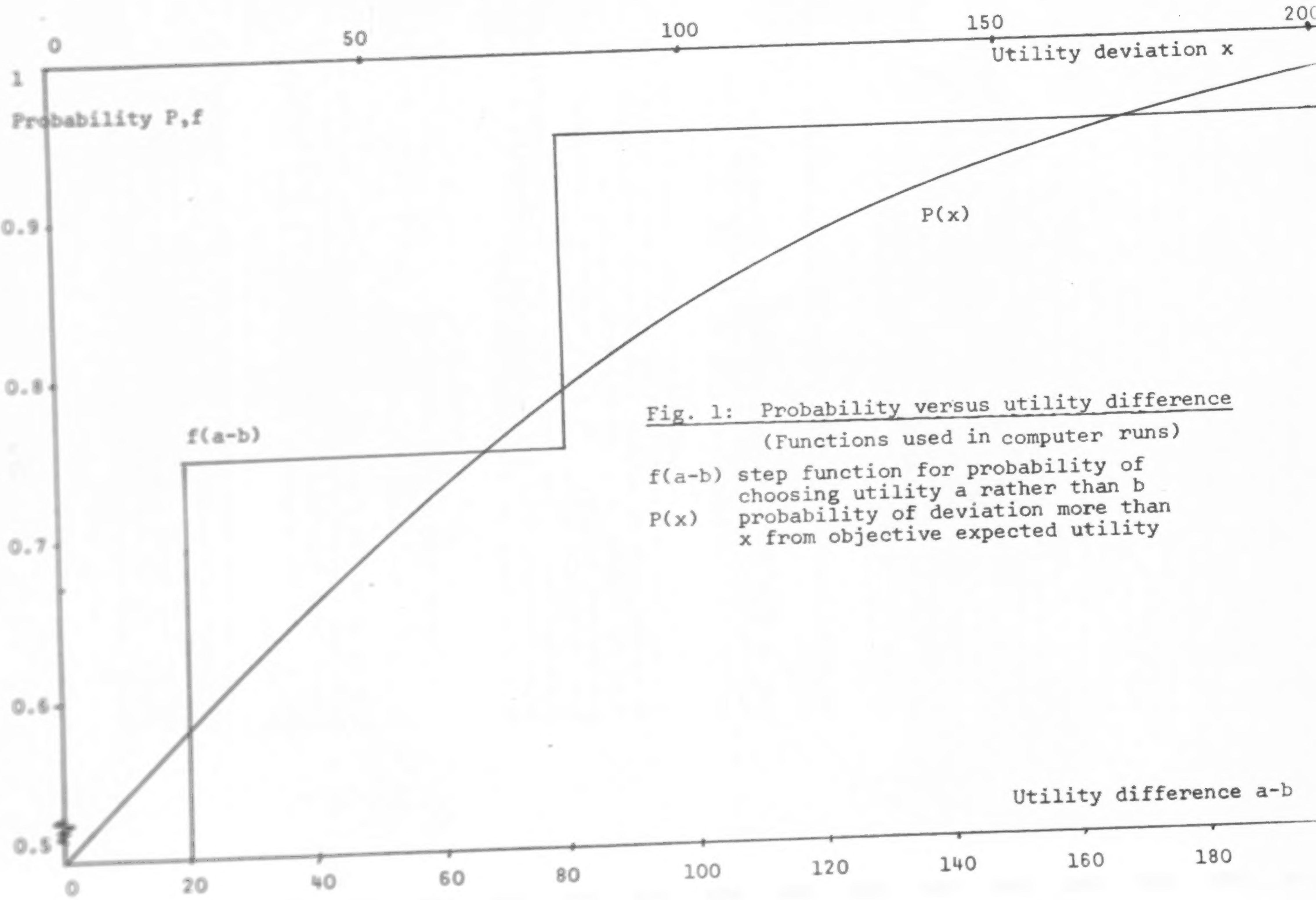

Fig. 1: Probability versus utility difference

(Functions used in computer runs)

f(a-b) step function for probability of choosing utility a rather than b

P(x) probability of deviation more than x from objective expected utility

Subjective and objective probabilities

We may regard the subjective expected utility u as embodying the individual's subjective estimate of the probabilities X, Y, ... of different outcomes of a certain choice, which have utilities x, y, ..., so that

$$u = xX + yY + \dots$$

But his estimate of the probabilities is subjective and formed from incomplete information; in fact, the outcomes will occur with objective probabilities depending on the circumstances, and the actual outcomes will affect his future estimates and hence his future behaviour. The objective probabilities would be determined by observing a large number of trials under similar circumstances. In our computer runs, we have used normal distributions for the objective probability of occurrence of outcomes of choices; the continuous curve in Fig. 1 is the actual distribution P(x) used. P(x) denotes the probability that a deviation greater than x from the mean, which is the objective expected utility, will be observed.

Conditioning

Experience will affect the individual's expectations, and it has been found that people almost always bias their expectations towards their most recent experiences, not usually using correctly all the information available to them from all past trials. If behaving quite rationally, an individual should be trying to reconstruct the objective probability distributions as best he can, using the deduced mean as his SEU value, but he is more likely in fact to use a rule of the form "new SEU = m(Old SEU) + (1-m)(latest outcome)", with $0 \leq m \leq 1$. Quite often m is very small, and we have in fact used m=0 in the computer runs, with an added restriction that the SEU values are not allowed to go beyond certain minimum and maximum limits whatever the outcomes may be.

Note that an alternative with a subjective expectation that is too high is likely to be chosen, and hence corrected, while one that is too low may never be chosen and hence will remain too low. Conditioning only operates as the result of experience. Of course, subjective utility estimates may be changed also by new information without personal experience, but this is a different process not at present built into the model.

4.6

Computer program

Initial trials have been performed with the program MOUSS 1* using the functions in Fig. 1. The program allows for a succession of runs with the same SEU values, each consisting of a succession of simulated daily decisions which can be broken down into the following steps:

A Sort workplaces into SEU order

B Examine SEU differences for lack of discrimination

C Choose workplace by given rule, using random number compared to step-function probabilities. If the highest utility is not chosen, use a second random number to choose between the other two

D Select actual utility in chosen workplace using random number in objective distribution P(x) centred on preset objective utility

E Modify SEU for chosen workplace to actual value just found or to permitted extreme value if actual outside range

F Return to Step A for next day unless run finished

A typical 10-day run of MOUSS 1 (13/3/69 Trial 16)

(chosen workplace for each day marked with *)

Workplace	College	Department	Library	Actual utility at *
Objective EU	600	1000	1200	
SEU for day 1	900	1200	1300*	1188
2	900	1200*	1188	933
3	900*	933	1188	699
4	699	933	1188*	1228
5	699	933	1228*	1142
6	699	933	1142*	1200
7	699	933	1200*	1182
8	699	933	1182*	1255
9	699	933	[illegible]	[illegible]

MOUSS 1* using the functions in Fig. [illegible]. The program allows for a succession of runs with the same SEU values, each consisting of a succession of simulated daily decisions which can be broken down into the following steps:

A Sort workplaces into SEU order

B Examine SEU differences for lack of discrimination

C Choose workplace by given rule, using random number compared to step-function probabilities. If the highest utility is not chosen, use a second random number to choose between the other two

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4	699	933	1188*	1228
5	699	933	1228*	1142
6	699	933	1142*	1200
7	699	933	1200*	1182
8	699	933	1182*	1255
9	699	933	1255*	1203
10	699	933	1203*	1087
Final SEU	699	933	1087	
Times chosen	1	1	8	

Note that all three SEU values were initially higher than the objective EU values and were reduced after being chosen, that the lowest utility was chosen at

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* standing for: Model of Undergraduate Self-Scheduling

Day 3 (the random number chosen first must have been greater than 94 to prevent the highest utility 1188 being chosen, and the second random number used to choose between utilities 933 and 900 must have been greater than 74), and that despite the considerable difference in utilities between college and department the same number of choices were made of each.

Three further sets of ten 10-day runs are summarised in Table 2, which gives only the initial and final SEU values and choice frequencies for each run, plus cumulated frequencies for each set of runs.

Inversion of computer model

Each set of runs comprising 100 simulated daily choices, the total frequencies quoted are immediately comparable to percentage probabilities, so that we can say, looking at Trial 12, that the percentage choice probabilities are 1% for college, 25% for department and 74% for library. How can we invert the model so that this information, which is all we can actually observe about the choice process, will tell us the SEU values? Of course, we cannot really say what is going on in the minds of the undergraduates, the most we can hope to do is to set some parameters of a model which reproduces the relevant features of their behaviour. Accepting this interpretation, our object in inverting this model will be to determine SEU values which will lead to the observed choice frequencies when the decision rules of the model are used. In the case of Trial 12, therefore, we can say very confidently that average SEU difference between library and department over the 100 trials must have been between 20 and 80, because the 74%:25% ratio is the choice function f(a-b) in Fig. 1. Further, since on 26 occasions the highest SEU was not chosen, we can say something about the SEU difference between the other two, department and college: the former was chosen just over 95% of the time, so we can say that its SEU value must have been greater than that for the latter by at least 80.

We chose an easy case to analyse, where the percentages happened to come out the same as the steps in the choice function; for other cases, such as Trial 9 (0%:21%:79%:) or Trial 10 (10%:20%:70%) we need more sophisticated argument to perform the inversion. The key is our rule that no discrimination is possible for utility differences less than 20: if we take a crude interpretation of this as being caused by a rectangular distribution of width 20 for utility differences, to be superimposed on the step-function f(a-b), we find quite simply that 70%

choice corresponds to a utility difference distribution centred at 26 (overlapping the first step), and 79% choice corresponds to a distribution centred at 84 (overlapping the second step). We can then refine our inversion of Trial 12, and deduce that if this distribution were used the SEU difference producing the 75% choice must have been centred between 30 and 70, since it did not overlap either step. Returning to Trial 9, we must conclude that the college SEU value was at least 90 below that for the department, while in Trial 10 the corresponding difference must have been centred at 24, since it produced 67% choice of the department rather than the college in cases where the library was not chosen.

What we have done is essentially to "smooth off" the steps in the choice function when using it for inversion; this could be done better by using a more sensible distribution than a rectangular one, but is hardly worth doing with these trial runs which do not represent actual behaviour observations.

Experimental tests and calibration

We have a model, and the program is working; the next stage is to make it reproduce undergraduate behaviour in relevant respects. We have information from our questionnaires to enable us to do this in quite sophisticated models, with many more than three options and with multiple activities. For the level of model so far programmed and described above, we might take global figures of undergraduate habits regarding places to work, as contained, for example, in Table 12 in Chapter 8, but it would be more meaningful to break down the undergraduate population into classes with common proportions of timetabled to untimetabled hours, and possibly subdivide further into classes with common journey-times. This part of the operation has not yet been done, but we intend to embark on it shortly, as stated in Chapter 10.

Table 2 Three sets of ten 10-day runs of MOUSS 1 (13/6/69)

Workplace	College		Department		Library	
	utility	freq.	utility	freq.	utility	freq.
Objective EU	600		1000		1200	
Trial 9 Initial	900		1200		1000	
Final Run 1	900	0	866	1	1190	9
2	900	0	912	2	1226	8
3	900	0	1018	4	1012	6
4	900	0	945	4	1233	6
5	900	0	961	2	1101	8
6	900	0	974	1	1215	9
7	900	0	919	1	1096	9
8	900	0	882	2	1292	8
9	900	0	1123	3	1101	7
10	900	0	959	1	1188	9
Total		0		21		79
Trial 10 Initial	1400		1200		1000	
Final Run 1	639	1	852	3	995	6
2	756	1	877	2	1182	7
3	674	1	844	1	1284	8
4	539	1	926	2	1164	7
5	588	1	936	2	1156	7
6	342	1	905	2	1044	7
7	667	1	942	2	1264	7
8	561	1	872	2	1250	7
9	516	1	795	1	1236	8
10	597	1	1015	3	1116	6
Total		10		20		70
Trial 12 Initial	900		1200		1100	
Final Run 1	900	0	948	4	1433	6
2	900	0	959	3	1244	7
3	900	0	982	1	1192	9
4	900	0	1047	1	1210	9
5	900	0	916	2	1328	8
6	900	0	866	2	1318	8
7	900	0	852	4	1297	6
8	900	0	1044	2	1205	8
9	900	0	844	4	1119	6
10	833	1	1047	2	1148	7
Total		1		25		74

In studying this table, it is essential to remember that the SEU values are reset at the end of each run to the initial values for the current trial: this is the explanation for the single choice of College in each run of trial 10, where it starts with a very high SEU value but gets immediately corrected once chosen.

CHAPTER 5

DATA COLLECTION: PURPOSES AND PROBLEMS

1. Purposes of Data Collection

Data is important at four stages of library planning. In the first stage, it describes situations, in the second it tests theories; when plugged into suitable models, it explains situations; and finally, it predicts.

Data collection can be very expensive, so the reasons for collecting it must be made quite explicit before a finger is lifted to count a single piece of paper. Mere description in itself is of little use. A common statement in the calendars of universities is of the form "The library contains more than 250,000 volumes." This is peculiarly ineffective propaganda for the most part: it can convey little meaning to the average reader of calendars.

Description can be meaningful when used comparatively. Consider these three statements, all of them paraphrased from annual reports of university libraries.

> "The library added 10,000 volumes to stock this year."
>
> "Acquisitions this year totalled 10,000 volumes compared with 8,000 last year."
>
> "This year we acquired 6,000 volumes by purchase, compared with 10,000 last year; the fall was due to a rise in the prices of British books, the effects of devaluation, and a book-budget pegged at the same level as last year."

The first statement is meaningless, and the second is very little better. The third is packed with social, political and economic information.

At the hypothesis testing stage, it is sometimes necessary to obtain data from other sources than the individual library in question. What will be the effects of changing the borrowing regulations in a university library? On a simple level, lengthening the permitted loan period from two weeks to ten weeks seems likely to reduce the circulation of books. Is this so? Data from a university where this change occurred, unaccompanied with any other major change, is as follows.

	No. of students	No. of books borrowed	Books borrowed per head
Old regulations	4100	82000	20.0
New regulations	4600	77000	16.7
Percentage change	+12.2	-6.1	-16.5

The evidence does not refute the hypothesis and it is worth pursuing whether such a change will reduce the availability of books and thus reduce the quality of the service provided. If the change in regulations were accompanied by special provision of books in heavy demand, on the other hand, the quality of the service might increase. Is there evidence from elsewhere to support this? From a university which changed the loan regulations and increased the supply of heavily used books at the same time, we find the following

	No. of students	No. of books borrowed	Books borrowed per head
Old regulations	2100	68000	32.4
New regulations		55000	23.9
Duplicate collection	2300	25000	10.9
Percentage change	+9.5	+17.6	+7.4

The effects of the two changes are difficult to disentangle. Taking the first two years of the new system, we find:

	No. of students	No. of books borrowed	Books borrowed per head
Year 1: New regulations		55000	23.9
Duplicate collection	2300	25000	10.9
Year 2: New regulations		55400	22.2
Duplicate collection	2500	35000	14.0
Percentage change	+8.7	+ 0.73 +40.0 } +13.0	-7.1 +28.4 } +4.0

The evidence is still not conclusive, and not much is gained by extending the exercise. The need for a suitable model is demonstrated. The particular case of loan regulations has been covered (Buckland & Hindle, 1969) and this admirably illustrates the use of data in models. Model-building automatically leads to prediction. Prediction is a pre-requisite of planning. Librarians must plan, therefore they must predict. Of course, some predictions fail - that is why governments fall - but adequate information assists in the refinement of prediction. Some forecasts fail because not all factors can be controlled - weather, prices of periodicals, builders who go bankrupt; others fail because measures are taken as a result of the forecasts - Britain's export performance, extension of opening hours - and this kind of failure only pays tribute to the value of the exercise. Predictions based on a sound foundation of relevant data are more likely to be more correct than those based on hunch or guesswork.

If the population served by a library increases, what effects will this have on the use of the library? How can the library administration adjust to cater for differing demands? These and other questions can be answered if the right kind of data is collected in the right way.

2. Classes of Data

At the outset of problem solving it is necessary to decide not so much how to collect the data, as what data to collect. Once it has been decided what is relevant, there is frequently an obvious way of obtaining the required information. The data concerning libraries can be grouped under four main headings: Resources, Activities, Operations and Background.

(a) Resources

These are usually the simplest of all to measure in terms of method, although not necessarily of effort. Labour, money, seats, shelves, and bookstock are all resources which can be counted in obvious ways. This does not mean that they always should be counted. Since books occupy shelves, it is not necessary to count both, unless one wishes to check the average width of books in various subjects. In a library, one of whose tasks is preserving books for the future, it is largely irrelevant exactly how many books it actually possesses; it is necessary to know how many empty shelves there are, and how quickly they are being filled.

(b) Activities

Activities can be sub-divided into librarians' activities and users' activities, but this is to be avoided if possible because such a sub-division tends to overlook the impact of each upon the other. Thus the lending service can be measured in terms of how many books are borrowed in a day, or in a year, and deductions made about the requirements for issue-desk staff; but account must also be made of the users' time: an issue system which requires two to three minutes of a borrower's time for every book borrowed is that much worse than one which takes fifteen seconds.

So, the activities group includes the services of the library - lending, reference, photocopying, etc.; the "internal" activities - acquiring books, administration, etc.; and the users' activities - using the catalogue, consulting books in the library, and so on.

(c) Operations

Operations are the links between resources and activities. The activity "acquiring books" involves professional, non-professional and clerical labour, money, and shelf-space; "cataloguing" may use professional and clerical labour, and machine-time (for reproduction of catalogue entries). At the very least, a manager needs to know how much of each resource is absorbed by each activity. Just as it is inconceivable that a refrigerator manufacturer should be ignorant of how long it takes to make one deep-freeze, so it should be inconceivable that a librarian be ignorant of the amount of time required to file a hundred catalogue entries. Planning without this kind of data is less credible than science fiction of the Barbarella genre.

(d) Background

Background data is mainly concerned with potential demand and external factors that influence the actual demand, e.g., the size of the undergraduate body and the subject coverage in a university library; Reilly's Law, and the relative proportions of differing socio-economic groups in a public library. All librarians should be concerned in establishing why substantial numbers of people never use their library, with a view to providing the services which will reach these non-user groups.

3. Problems of Data Collection

Deciding what data to collect is largely a matter of the problem on hand. When planning a new extension to a library building it may be sufficient to calculate how fast the existing shelf space is filling up, in overall terms such as "3000 feet per year". When re-arranging material within an existing building, it is necessary to be able to differentiate between subjects, as perhaps "Physics: 80 feet per year; Geology: 43 feet per year".

Each of the four classes of data mentioned above has its own peculiar problems to be overcome with sufficient exercise of ingenuity and steadfast adherence to the principle of least effort.

(a) Resources

The measurement of resources such as staff, seats and money is automatic: the librarian knows how much money he has to spend, how many seats the readers may use, how many graduates there are on his staff. It may be necessary to classify the resources in different ways - professional staff, experienced and inexperienced non-professionals, clerical, etc.; seats for students, seats for professors, etc. - but that will depend on local conditions and is not a problem of measurement.

(b) Activities

There is scope here for expending much effort for little return. The annual collection of statistics can degenerate into a meaningless ritual unless the object of the exercise is continually borne in mind. There is no point in knowing that only five per cent of inter-library loans are supplied through the regional bureau unless (for example) a decision is to be taken on the desirability or otherwise of maintaining a connection with it. Similarly, there is a danger in carrying out surveys of library use merely to satisfy curiosity. To know that one-fifth of all the users consult the catalogue on a particular day is not sufficient; it is necessary to know how this compares with other days, other times of year, other institutions; and if there are differences, what causes them?

Data collected in surveys of other libraries can often be useful. In the case of catalogue use, figures are available from a variety of sources.

	B'ham 64	Durham 66	Newcastle 68	UMIST 65
% of undergraduate users using catalogue on a given day	25	20	6	19
% of academic staff users using catalogue on a given day	Not available	26	15	19

Questions are instantly raised by comparisons of this sort.

The non-use of libraries occasionally gives librarians furiously to think: also the non-use of books by library users. Large numbers of students can always be found in university libraries before the summer term exams working solely with their own books. Data from a number of libraries suggests that the figure is around 50-60% of the total. The proportion is not inconsiderable at other times of the year however.

All surveys in May	B'ham 64	Durham 68	Keele 67	Newcastle 68	UMIST 65
% of undergraduate users not using library materials	54	54	45	63	51

A curious aspect of non-use is provided by the category of users known as "External" (i.e. non-university users). It was noticed that at Durham in 1966, one-third of this category used no library materials when in the library; similar results were obtained in Newcastle in 1968, and another case has occurred in Sydney (Radford, 1967)!

(c) Operations

This is possibly the largest terra incognita of librarianship. At any rate the literature is singularly deficient in information on the allocation of resources to activities. A recent study gives some data on the amount of labour allocated to particular tasks in certain types of academic libraries (Friedman & Jeffreys, 1969); but this is not related to the output resulting from the labour force. A recent work on productivity tells of a university library in which six professional librarians catalogued five books each per day (Butterworth, 1969): this suggests that one library at least believes that "each book is a law unto itself" (Berkowitz, 1961). This attitude appears to be quite common, and may prevent the collection of data on operations in all branches of library work. It may well be true that all books are exceptions (in which case why are there cataloguing rules?). It is certainly true that the time taken to issue a book should be independent of its intellectual content and physical characteristics.

In the absence of concrete data, some initial comparisons are possible at a very crude level. It is usually possible to find somewhere in Britain two libraries with similar characteristics. Data taken from the annual reports of two such libraries can throw up some interesting comparisons.

	No. of students	Academic staff	Library staff (Grad.)	Library staff (Others)	Loans per member of library staff	Additions to stock per member of library staff
Univ. A	2850	420	21	24	3000	625
Univ. B	3000	400	20	22	1800	350

Annual reports of other institutions can suggest many comparisons of this sort; a closer look at the reasons underlying differences can be of great assistance in exposing inefficient working or redundant practices.

(d) Background

The problem here is of determining what is relevant. Other people's surveys can be of great use in highlighting particular aspects and suggesting new avenues of thought. Distance from place of residence to library (Luckham, 1967) - how does this operate in a university library situation? Is it obscured by the difference in need of different academic disciplines? Can librarians glean anything from the evidence garnered by behavioural psychologists, to assist them in planning the interior arrangement of libraries?

4. Conclusion

This chapter has examined the purposes of data collection, the main ones being the collection of evidence to test hypotheses, and to assist in problem solving. It has proceeded to examine the four main classes of data concerning libraries, under the headings Resources, Activities, Operations and Background. Under these same headings, some problems involved in Data Collection have been discussed. In the next chapter, various methods of collecting data, used in this project, are described and assessed.

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CHAPTER 6

DATA COLLECTION METHODS

A. Preparation

In the course of our investigations, we have carried out a number of different types of survey. Irrespective of the type of survey, however, we found it important to make careful preparations, covering the following:-

a. Definition of the object of the survey
b. Design and type of form to be used
c. Pilot trial of the form on selected individuals
d. Administrative arrangements for carrying out the survey

Definition of the object of the survey

We found that the most important single factor in carrying out a successful survey was the need to define accurately the purpose for which the survey was required. Sometimes the object was to investigate a number of different activities. On other occasions the investigation was limited to one or two specific items. In every case we tried to keep the object clearly in mind whilst the form or questionnaire was being designed.

Design and type of form to be used

The design of the survey form had to be carefully planned. We had to ensure that questions were not ambiguous, and that it was clear to the individual exactly what sort of answer was required. This was particularly important in the case of postal surveys, or where the subjects were unable to obtain more information when they were in doubt. In the case of interview surveys, we deemed it important that the interviewers were all carefully briefed by the same individuals, to ensure that interviewers put the same emphases on the questions. In the case of postal and "instant diary" - see below - surveys, we tried to keep the list of questions reasonably short. For "instant diary" surveys, we normally used cards or postcards, as these are easier to fill in on the spot. As well as ensuring that questions were framed in pursuit of the object of the survey, we also tried to make the answers easy to analyse. For this purpose, YES/NO answers were asked for wherever possible, and we found it better to group such questions as far as it was logically possible. Where numerical answers were required, e.g., costs, percentages, we found it more satisfactory to ask individuals to record the approximate figure, rather than to provide a series of boxes - e.g., 0-25, 26-50, etc. This method enables statistics to be calculated, and it is always possible to group the answers later. We also found it desirable to provide a space for respondents to record "Other Comments". These were often difficult to analyse, but frequently such comments revealed points of importance and interest, and the space provided helped to avoid the whole questionnnaire being covered with illegible writing.

We tried to take care over the layout of the questionnaire from the analysis point of view, particularly as answers to questions often had to be punched for subsequent analysis by computer. One of our more successful efforts was the original "Instant Diary" form - see Annex 2 - where numbered boxes were provided for nearly all the answers, down the right hand side of the form. This enabled the punch operators to punch out the information with little need for supervision by the project staff.

To sum up, when designing our survey forms, we tried to keep in mind the object of the survey, the method of analysis, and the sheer mechanics of it, including the punching of data.

Pilot trials

Having designed a questionnaire, we found that it was desirable to try it out on some selected individuals. (It is, of course, good practice, when open-ended questions are used, to try them out on a larger number of people - up to 70 or 80 perhaps. An important further stage is to try out a revised version on a further sample of the population, to see that the questions are now correctly framed, and that the answers are easy to analyse.) In our postal surveys we checked on the time taken to answer all the questions, and noted any ambiguity. A discussion with the guinea-pigs made it clear how difficult they found it, and what alterations had to be made in order to minimise doubts.

Administrative arrangements

Under this heading we included the final preparations needed to carry out the survey successfully. High on the list we placed the need to obtain the co-operation of the subjects of the survey, and of all others whom the survey would affect, such as Library staff, Departmental and Administrative staff. Without such co-operation we realised that surveys would be fore-doomed to failure.

In the case of Instant Diary and Interview surveys, a small staff was required. We were able to draw on post-graduate and undergraduate students for this, and for the most part they undertook their duties loyally. We usually made some payment for their services.

Preparation and printing of questionnaires and survey forms had to be arranged so that they were ready in time for each survey, and also such little equipment - e.g., a time-date stamp - as was needed had to be gathered together.

B. Details of types of data collection carried out

The following different types of data collection methods were used:

1. Instant Diary Surveys
2. Postal Questionnaire Surveys
3. Interview Questionnaire Surveys
4. Data from normal library records

Statistical details of each survey are given in a list at the end of this chapter. Information about the storage and analysis of the data is given in Appendix 5 to the Report. Principal results and discussion of their relevance is given in Chapter 7 (Current Awareness Surveys) and Chapter 8 (Other Surveys). A description of examples of each type of survey follows.

1. Instant Diary Surveys

(a) At the start of the project, in October 1966, the project staff decided that it was necessary to analyse the types of library user at Durham, and the uses which they made of the University Library. It was decided to carry out a survey for a complete week in each of the three sections of the University Library, namely, the Arts/Social Science, Science, and Oriental sections, which are all in different parts of the city. It was further decided that the survey should be carried out in November 1966, during the Michaelmas term.

A survey form was designed (Annex 1) and about 100 copies were used in a pilot survey. Two particular alterations were included as a result - (i) "TYPE OF USE": many respondents gave details of all the uses they had made of the library since coming to Durham; (ii) "Time of Entry" was confusing - many people thought it meant "Year of Entry to the University". The final version at Annex 2 shows these modifications, and other alterations resulting from the pilot survey, discussions with library staff, and consideration of ease of punching and analysis. At the same time, the dates for the surveys were fixed with the University Librarian. We have called this type of survey "Instant Diary" because it involves the users in recording their library activities while they are still in the library, and does not delay them on their departure - a common fault of the interview method frequently adopted. This method of administering a survey proved successful and was repeated on a number of occasions.

The survey team was recruited from undergraduates who were known to members of the project staff and were considered reliable. They were adequately briefed and supervised by project staff, and a rota system was arranged to cover all the hours for which the library was open. Survey cards were handed to every person entering the library, the survey team having first recorded the time of entry in the appropriate space - normally with our time-date stamp. Library users were asked to answer the questions whilst they were in the library, and to hand the survey card back to the survey team on departure, when the time of departure was recorded.

Visitors to the library were generally co-operative, though inevitably there were a few who refused. The survey team noted each refusal by inserting a blank card in the appropriate space. Inevitably, also, there were some spoiled cards, but we achieved about 96% response.

As has been previously discussed, the design of the form was good. The questions were straightforward and unambiguous, and there were very few problems, either for the respondents, or for the punch operators.

For comparison, similar surveys, using the same form, were carried out on other occasions during the year.

(b) In November 1967 the A/SS and Science sections of the Durham University Library were again surveyed. In this case the object was to try to discover the extent of the "unrecorded" library use - that is, the use made of the library for which no records (such as borrowing slips, etc.) are maintained. The forms used for this were printed on post cards and a sample is shown at Annex 3.

(c) In February 1968 surveys were carried out using the same method, at Newcastle University Library and eight Departmental Libraries at Newcastle. The form used in these surveys is shown at Annex 4. At first glance it appears similar to the Durham Survey card (Annex 2). The object of the survey, however, was slightly different. As well as categorising types of use against classes of user we wanted to know the movements of each user - where he had come from to visit the library, and what was his next port of call. From this we hoped to establish a "use pattern". Also, as with the previous survey, we wanted to know the places in the library visited for consultation and the subjects consulted. The form was an excellent technical production. The map is extremely clear, and was a good way of eliciting the information required, and the response was excellent.

(d) On Monday, 6 May 1968, the final Instant Diary Survey of the series was carried out simultaneously in the Arts/Social Science section and the Science section of the Durham University Library, and in the University Library at Newcastle. The form used for this survey is shown at Annex 5. Apart from the usual personal particulars and timings in and out of the library, we were here concerned with the number of items of library stock used in the library - i.e. a quantitative measure of unrecorded use of the Libraries, and so this survey was complementary to the one described at para (b) above.

These cards did not need pre-coding and were immediately handed over to the punch operators. In this case, the design differed from previous forms as it had the principal questions 1 and 2 on the obverse, with the spaces for recording times of entry and departure. Personal details were printed on the reverse, with the answers recorded as tick in boxes down the right hand side of the card. Once again, the response was about 100%.

2. Postal Questionnaire Surveys

It was appreciated from the start of the project that surveys outside the university library buildings would have to be carried out in order to try to get a complete picture of library habits throughout each university. The method used was by postal questionnaire, and the first survey of this type took place in Durham during November 1966.

(a) The form used is shown at Annex 6 "PEBUL TERM-TIME 7-DAY ACTIVITY SURVEY". Copies of the questionnaire, with a covering letter, were sent out to all members of the Academic Staff and all Research Students, asking them for information about their use of the Libraries in Durham, and their teaching and research activities, during the previous seven days. They were also invited to list their main sources of professional information.

The design of this form was the subject of considerable thought. The project team decided to avoid producing a lengthy questionnaire, which would be tedious to complete, and therefore likely to produce a poor response.

(b) The term-time activity survey was followed up, to Academic Staff only at Durham, by a Vacation week and Information Source Survey in April 1967. The form used for this survey is shown at Annex 7. Questions A and B asked for much the same information as the Term-Time Survey, but Question C gave a tabulation of information sources obtained from the final question of Annex 6, which respondents were asked to mark in order of importance.

(c) The remaining postal questionnaire surveys carried out by the team were those connected with the Newcastle University series, and similar but not identical forms were used in all four cases

(Undergraduates, post-graduate students, senior Academic Staff and Junior Staff). An example of the type of questionnaire used is given at Annex 8.

The first to be distributed was a postal questionnaire to undergraduates. A 20% stratified sample of undergraduates was selected from the published course list of students. The selected names were then collected together in groups of about 20, keeping them as far as possible arranged by years and course. A student was then selected as "team leader" - this was normally the first on the list, unless for some particular reason he was deemed unsuitable (e.g., a foreigner, or someone living in "digs" some way out of Newcastle). 47 such teams and team leaders were selected in this way, and a letter was addressed to each person, explaining the reason for the survey, and trying to provide the necessary motivation for them to complete the questionnaire.

To start the process, the team leaders were written to and asked to collect from the library the list of names and a bundle of forms in an envelope for their team. This enabled the project team to have some check at least, that the team leaders were interested enough to collect their envelopes. All but 3 or 4 envelopes were collected satisfactorily; a second individual in the defaulting teams was then approached, but in the end we had to deal with two teams on an individual postal basis. Of the 994 forms distributed, we eventually recovered 580 which had been completed.

Before the questionnaire was printed, a few copies were run off, and handed out to a representative selection of undergraduates in the library, as a trial run. They took between 20 and 35 minutes to complete the forms, excluding the question on the list of book loans. As a result of this preliminary trial, a few minor alterations were made to the questionnaire, and one question cut out, but otherwise it was considered satisfactory. As the questionnaire had a dual purpose (Newcastle University wanted information to enable replanning of library buildings to be carried out) the questions were more searching than was the case at Durham.

(d) Shortly after setting up the Undergraduate Sample Survey, a survey of all post-graduate students was mounted. As before a trial run was carried out in the December vacation. This trial run was carried out after the undergraduate trial run, but even so some lessons were learnt. We found, for instance, that a number of abbreviations which were familiar to us (such as I.L.L. - Inter Library Loan) were not known to the respondents, and as a result the names were printed in full on the final version. The agreed form was also used in a survey of Senior Staff and Research Assistants.

(e) To complete the picture, a postal survey was carried out, through Departmental Secretaries, of all full-time members of the Academic Staff down to and including lecturers. This was done in February 1968, and respondents were asked to return their completed questionnaires direct to the Deputy Librarian.

A particular facet of this survey was that members of staff were asked to rank their sources of information on a given list, which was similar to one asked for Durham Staff. A comparison of the results achieved showed a high correlation between the ranking of information sources used by staff at the two Universities.

3. Interview Questionnaire Surveys

(a) During the initial stages of the project at Durham, it was decided that, as well as the Postal Survey of Academic Staff and Research students detailed above, a 100% survey of undergraduates and others should be carried out on an interview basis in the hope of achieving a good response. For this purpose, a questionnaire was designed and is shown at Annex 9.

As Durham University is organised by Colleges, we used the existing College administration to help with this Survey, and to provide volunteers to carry out the interviewing.

The project staff carried out the briefing of the interviewers in three sessions - care being taken to ensure that exactly the same instructions were given at each session. The interviewers were wanted only to interview undergraduates, as post-graduate students living in the Colleges had already been dealt with in the postal survey.

Each College appointed a student in charge of the team, who co-ordinated the survey by giving each team member a list of students to interview. It was felt important to maintain anonymity as far as the project staff was concerned, although of course each interviewer was aware of the identities on his list of students.

Methods employed to carry out the survey varied. Some handed out forms to all fifty on the list, to enable them to collect together the required information, such as the number of books on loan. At a second visit, the interviewer recorded the information required and cross-examined each student to ensure accuracy. Others completed each form separately in one visit to each student. Yet others interviewed their students in groups, and completed the forms collectively as far as possible.

Taking a closer look at the Questionnaire itself, the designers tried to balance two requirements:

(i) ease of eliciting information from the interviewees

(ii) ease of punching and analysis

In the case of this interview type of questionnaire, it was considered less important that the form should be completely foolproof and self-explanatory, since the interviewers were carefully briefed, and could ask questions to elucidate the answers. The questionnaire was designed in the very early stages of the Project, when it was by no means clear exactly how it would develop. It was therefore all the more gratifying to find, some two years later, how well the Survey fitted into the requirements of the later stages of the project. Information culled from different parts of the Questionnaire has been of use in widely different investigations.

(b) Two other surveys to come into this category were carried out in connection with the Current Awareness Service; these are described in detail in Chapter 7 of this Report.

4. Data collection from normal library records

The records kept by librarians in the normal course of efficient management are an important source of data in investigations of the type carried out during this project. We have made a particular effort to cull data from library loan records, both at Durham and at Newcastle, and we have also used turnstile records of numbers of people entering or leaving the library to back up our "Instant Diary" surveys.

(a) "Overlap" Surveys

The designation "Overlap Surveys" has been used by us to describe the use we have made of information contained in library loan records, to attempt to establish the extent of interdisciplinary book borrowing from an academic library.

Both at Newcastle and at Durham, the borrowing system involves the completion by borrowers of issue slips. These slips contain the following relevant information:

Dewey Class No.: Author: Accession No.: Title
Surname of Borrower: College/Address: Date Borrowed

For the purpose of this project, it was also necessary to know the date of return, and to obtain further particulars about the borrower - in the case of staff and research students the borrower's department, and in the case of undergraduate and other students details of the borrower's course. The date of return was obtained by, in the case of Durham, providing a date stamp for use by the library assistants, and also by the fact that returned library slips were bundled together and dated in each university library. Details of borrowers' departments/courses were obtained by consulting the relevant lists, which involved considerable effort.

The teaching departments of a university often correspond in name to the primary divisions of the book classification scheme used in the library. In the Dewey Decimal scheme - used both at Newcastle and at Durham - 530 corresponds to Physics; 780 Music, etc.

"On-subject" borrowing is defined as the borrowing of books, by members of a department, classified within the division of the same name - thus "on-subject" borrowing by a member of the Department of Politics would be from class 320.

A matrix of observations can be built up showing the numbers of books borrowed from each class by each department, and proportions calculated to indicate the overlap, in two further matrices:-

(i) showing the proportion of books that a member of a given department borrows from a given class, when he borrows any book. The leading diagonal of this matrix yields the proportion of "on-subject" borrowing for each department

(ii) showing the proportion of books of a given class that were borrowed by members of a given department, when any book of that class is borrowed

Two types of survey have been carried out at Durham and Newcastle:

1) Retrospective: the analysis of loan records (library issue slips) for books returned to the library during a given period.

2) Snapshot: the analysis of loan records for books on loan at a given point in time.

Retrospective Overlap Surveys

At Durham, loan records for a period of one year have been punched for analysis by computer. This has been a considerable effort on the part of the punch room staff, and is not a thing to be undertaken lightly. It would have been easier in the case of any library employing a mechanised issue system, where the task of recording the data is simple.

At Newcastle, a retrospective survey covering October-December 1967, of staff borrowing was carried out, and the results compared with data made available by Mr. W.L. Saunders, from his survey of borrowing at Sheffield University Library during 1960-61. This technique of comparison provides the main strength of such a survey.

The results could be used to indicate the degree of inconvenience which could be caused if it were necessary to split a single university library into faculty-based sections.

In addition, a retrospective survey of undergraduate borrowing was carried out for one week during December 1967 to test the hypothesis that undergraduates borrow mainly "on-subject", and this survey did support the hypothesis.

Snapshot Overlap Surveys

Two pilot surveys of the snapshot type were carried out in Durham to determine the feasibility of this type of survey, and to estimate the scope and nature of the overlap. As a result, a snapshot survey was carried out at Newcastle in mid-March 1968. A team of people visited the library on a Sunday - when it is normally closed - and listed all the books out on loan by both staff and students. This was comparatively simple, as loan records (library slips) are filed in boxes alphabetically against the names of staff and students. In the case of staff alone, nearly 6,000 books were out on loan, and these were listed against each member of staff borrowing.

At a later date, members of staff were identified by Department, and students by course, and classification numbers of books were checked, before separate analysis by computer.

Thus the snapshot survey gives a spot check on all books out on loan. This may be misleading because equal weight is given to all books irrespective of loan period, and the analysis needs to be looked at in conjunction with the more solid statistics provided by a retrospective survey, over a longer period.

(b) Turnstile records

The team found that turnstile records of people using libraries were a useful source of data. At Durham, the Science Library is equipped with a recording turnstile at the exit, and readings were kept for the first year of the project. These readings were useful as a background against which to look at Instant Diary Surveys, each such survey giving a breakdown of the population entering or leaving the library over the period of the survey. In the case of the Arts/Social Science Library, a recording device was improvised, with the help of the Applied Physics Department of Durham. This device comprised an electronic counter, to which was connected a "pressure pad" type of burglar alarm. This pressure pad was placed under the rubber mat at the revolving door entrance to the library, and was found to be accurate to within 5%.

C. Conclusion

We have tried in this paper to give an account of the various types of surveys, and data collection methods which have been used on the project. This is not a comprehensive list of all possible methods that can be employed, but we think that we have probably carried out as many surveys under one project as have ever been attempted in the library field. We think that we have devised methods which cause the least interference to library users and library staff, with the object of minimising refusals to co-operate. Reports on the analysis of data collected by these methods are contained in Chapter 7 (Current Awareness Service), Appendix 8 (Unrecorded Use), and Chapter 8 (Other Surveys). We hope that our experience may be of benefit to other people who may be contemplating this type of activity.

6.12

Bibliography

This is not a complete reading list. It merely lists the more important studies which have been useful at some stage during our considerations on surveys and survey methods.

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Surveys carried out by PEBUL, November 1966 - May 1968, in the Universities of Durham and Newcastle

1. Instant Diary Surveys

Code No.

A1D All users of the Durham Arts/Social Science Library: 17-23 Nov. '66

A2D All users of the Durham Science Library: 21-26 Nov. '66

A3D All users of the Durham Oriental Library: 21-26 Nov. '66

These three surveys used the same card form (Annex 2), to elicit information on the extent and nature of library use. Response was ca 96%. Materials cost £10. Extra labour £45. The card took 90 seconds to complete.

The same form was used again in one-day surveys six months later.

A12D Arts/Social Sciences: 16 May '67

A22D Science: 11 May '67

A32D Oriental: 18 May '67

No extra labour was employed. Materials cost was included in that for the first group.

……

F1D All users, Durham Arts/Social Sciences Library: 23 Nov. '67

F2D All users, Durham Science Library: 28 Nov. '67

Response: ca 96% Materials cost: £7
Extra labour: nil

Postcard size forms (example Annex 3) were used: information was sought on the areas of the library used, and on the subjects of the books used inside the library. An attempt was also made to discover whence library users had come, and whither they were going. The card took 60 seconds to complete.

……

K1N All users, Newcastle Main Library: 22 & 27 Feb. '68

Response: 97% Materials: £38
Extra labour: £13

6.14

A card form (Annex 4) was used. Information was sought on extent and nature of use in the library; areas of the library used; subjects of books consulted; place of origin and destination of library users. The card took about 2 minutes to fill in. The card combined features of those used in the A series and F series of surveys (above) and likewise was partly easy to analyse and partly difficult.

The same card was used two weeks later.

K4N All users of 8 departmental libraries, Newcastle: 12 Mar. '68

Response: ca 96% Materials: see K1N
Extra labour: £10

……

M1D All users, Durham Arts/Social Science Library: 6 May '68

M1N All users, Newcastle Main Library: 6 May '68

M2D All users, Durham Science Library: 6 May '68

Response: ca 96% Materials: £17
Extra labour: £12

A postcard (Annex 5) was used asking for information on the number of books used in the library. The card could be completed in 20 seconds. Analysis was simple.

……

2. Postal Questionnaire Surveys

B6D Durham Academic Staff. Response: 82%

B8D Durham Research Students. Response: 56%

Materials: £3 Distributed: mid-Nov. '66

A single foolscap sheet (Annex 6), most of which was left blank for the recipients to describe their information seeking habits, and to let off steam generally. The data was sought on extent and nature of use in the library; areas of the library used; subjects of books consulted; place of origin and destination of library users. The card took about 2 minutes to fill in. The card combined features of those used in the A series and F series of surveys (above) and likewise was partly easy to analyse and partly difficult.

The same card was used two weeks later.

K4N All users of 8 departmental libraries, Newcastle: 12 Mar. '68

Response: ca 96% Materials: see K1N
Extra labour: £10

……

M1D All users, Durham Arts/Social Science Library: 6 May '68

M1N All users, Newcastle Main Library: 6 May '68

M2D All users, Durham Science Library: 6 May '68

Response: ca 96% Materials: £17
Extra labour: £12

A postcard (Annex 5) was used asking for information on the number of books used in the library. The card could be completed in 20 seconds. Analysis was simple.

……

2. Postal Questionnaire Surveys

B6D Durham Academic Staff. Response: 82%

B8D Durham Research Students. Response: 56%

Materials: £3 Distributed: mid-Nov. '66

A single foolscap sheet (Annex 6), most of which was left blank for the recipients to describe their information seeking habits, and to let off steam generally. The data thus gathered was used to design the form for a subsequent survey (D6D).

Analysis was more interesting than simple.

……

D6D Durham Academic Staff. Response: 73%
Materials: £2 Distributed mid-April '67

A single foolscap sheet (Annex 7), asking recipients to rank named information sources (derived from their replies to B6D). Also asked about vacation use of libraries outside Durham.

Analysis was simple.

G9N Newcastle Undergraduates (20% stratified sample)

Response: 61% Materials: £2
Distributed late Jan. '68

Five foolscap pages (similar to Annex 8). Most questions fairly easily answered. The survey was concerned with library use and working habits, and attitudes to university and departmental libraries.

Analysis quite difficult for some questions.

....

H7N Newcastle Junior Academic Staff Response: 35%

H8N Newcastle Postgraduate Students Response 79%

Materials: £24 Distributed late-Jan. '68 - mid-Mar. '68

Six foolscap pages (similar to Annex 8). Questions on library use, information seeking habits, working habits. Some questions required thinking about. A minimum of 20 minutes required to complete this questionnaire.

Analysis quite difficult for this type of questionnaire.

....

J6N Newcastle Academic Staff (down to Lecturer)
Response: 58% Materials: £14
Distributed mid-Feb. '68

Four foolscap pages (similar to Annex 8). Questions on library use and information seeking habits. Also asked to rank information sources (based on D6D above). As in H series, questions often required thought.

Analysis again quite difficult.

....

3. Interview Questionnaire Surveys

C9D Durham undergraduates. Response: 72%
Materials: £8 Extra labour: £95
Distributed late Nov. '66

Two single-sided foolscap sheets, seeking information on library use and working habits of undergraduates.

Straightforward tabulation of replies is easy; correlation difficult because of the sheer bulk of the data.

L6D Durham Academic Staff who receive Social Science Current Awareness Service.
Response: ca 95% Materials: £1
March '68

A preliminary evaluation of the current awareness service (see Chapter 7). Questions required some thought, but assistance was given where necessary by one of the Project leaders.

Analysis simple.

N6D Distribution and response as for L6D.
Materials: £1 June '69

The final evaluation of the Current Awareness Service (see Chapter 7).

ANNEX 1

UNIVERSITY OF DURHAM

LIBRARY SURVEY

Please co-operate by completing this form, and handing it in on departure. Place a tick (✓) in boxes where the answer is "Yes".

Undergraduate?(except B.Ed) ☐ } College........... Living in College? ☐
Student at College of Education? ☐ } Year & Course.......

Graduate Course? ☐ Staff? ☐ } Please give Dept. & { ....
Research Student? ☐ Other? ☐ } Other relevant details { ....

Q1. Time of Entry ....
Have you visited this library previously today? ☐
How many times?..........

TYPE OF USE

Q2. To find books/periodicals/other items, titles known?...... ☐
No. required........ No. found ....

Q3. To find information on a specific topic(titles not known)? ☐
Did you find it?.. ☐

Q4. To browse, or keep up to date? .... ☐

Q5. To work without using library books or services? .... ☐

Q6. Did you return any books? .... ☐

Q7. Are you borrowing any books? .... ☐

Q8. Did you use a catalogue? .... ☐

Q9. Other uses? (e.g. recreational reading, admin.etc.) ...... ☐
Please specify ....

TIME IN

ANNEX 2

TIME OUT

UNIVERSITY OF DURHAM

LIBRARY SURVEY

IMPORTANT. Please place a TICK (✓) in BOXES where the answer is 'YES'.
Leave all other BOXES BLANK. COMMENTS on reverse ONLY, PLEASE.
Answer either A or B. Then complete C.

A.

Undergraduate? (incl. B.Ed.) ☐ 1.
Certificate Student at College of Education? ☐ 2.
College - ....
Living in College? ☐
Year & Course - ....

B.

Graduate Course? ☐ 4.
Academic Staff? ☐ 5.
Research Student? ☐ 6.
Other? ☐ 7.
Please give Dept. and other relevant details. - ....
....
....

C.

TYPE(S) OF USE - THIS VISIT ONLY

To find specific items of library stock, titles known? .... ☐ 8.
Number looked for - .... Number found - ....

To find information on a specific topic (titles not known)? .... ☐ 9.
Did you find it? .... ☐ 10.

To browse, or keep up to date? .... ☐ 11.

To work without using library stock? .... ☐ 12.

Did you return any books, etc? .... ☐ 13.

Are you borrowing any books, etc? .... ☐ 14.

Did you use a library catalogue? .... ☐ 15.

Other uses? (e.g. consulting library staff, recreational reading, etc.) ☐ 16.

Please specify ....
....

How many times have you visited this library previously today? - ....

ANNEX 3

TIME IN

P.E.B.U.L. SURVEY

TIME OUT

Please place a tick (√) where the answer is YES.

OBVERSE

A. Undergraduate? (incl B.Ed.). ☐ 1. College ....
Cert. student at Coll. of Ed?. ☐ 2. Year & Course ....

B. Academic Staff? ☐ 3. Graduate Course? ☐ 4. Dept. & other details ....
Research Student? ☐ 5. Other? ☐ 6. ....

C. 7. Where have you just come from? ....

8. Are you working without using library stock? ☐

9. Where do you intend to go on leaving the library? ....

10. Are you returning books, using Inter library Loan, Xerox etc? ☐

P.T.O.

NPG.

REVERSE

11. Did you consult, or collect, material on the shelves? If so, mark a tick (√) against the place where you did this, in the list below. DO NOT include books which you are taking out on loan.

12. In the same list, underline any room where you sat down to work.

New Extension

Gallery
Reading Room
Stack A
Stack B
Stack C

Room 6
Room 7
Room 2

Old Building

Room 5
Room 4
Room 3
Catalogues etc.

Special Collections
Recent Accessions
Issue Desk.

ANNEX 4

Reverse

ere are you going to when you
ave the library?

....

s, please give name of

e you came from) and 'B'
, mark 'A' or 'B' outside

WALLSEND
HEBBURN

Obverse

TIME IN

UNIVERSITY OF NEWCASTLE
LIBRARY SURVEY

TIME OUT

IMPORTANT. Please place a TICK(✓) in BOXES where the answer is YES. Leave all other boxes BLANK

ANSWER either A or B or C

Sex? M.F.

A. Undergraduate?(incl.B.Ed) ☐ 1. } Year 1 2 3 4 5 6 7 - Course ....
Postgraduate Instructional Course? ☐ 2. } please ring as appropriate

B. Research Student? - - - ☐ 3. Year of Research 1 2 3 4 Dept. ....

C. Academic Staff? - - - ☐ 4. Dept. ....
Other? - - - - - ☐ 5. Please specify ....

TYPE(S) OF USE - THIS VISIT ONLY

Borrowing Books? - ☐ 6.
Returning Books? - ☐ 7.
Consulting Books? - ☐ 8.
Consulting Periodicals? ☐ 9.
Consulting Library Staff? - ☐ 10.
Using Catalogue? - - - ☐ 11.
Place to work? - - - - ☐ 12.
Copying Service? - - - ☐ 13.
Other? - - - - - ☐ 14.

Which sections of the library have you used for consultation this visit? 15.

In the following list underline Area & Subject as applicable.

IGNORE THIS QUESTION IN THE CASE OF DEPARTMENTAL SURVEYS.

AREA	SUBJECT
GROUND FLOOR	Philosophy, Psychology, Religion, Archaeology, Language, Literature.
GROUND FLOOR EXTENSION	Social Sciences, History, Blue Books.
ARTS READING ROOM	
REFERENCE ROOM	
PERIODICALS	
BIBLIOGRAPHY ROOM	
FIRST FLOOR STACK	Law, Fine Arts, Music.
SECOND FLOOR STACK	Education, Geography.
THIRD FLOOR STACK	General Science Periodicals.
THIRD FLOOR EXTENSION	General Science Books, Maths, Physical Sciences, Geology, Life Sciences.
FOURTH FLOOR EXTENSION	Engineering, Agriculture.
FIFTH FLOOR EXTENSION	Medicine.

How many times have you visited this library previously today? .... 16.

P.T.O.

17. Where did you come from to the library? (see note below)

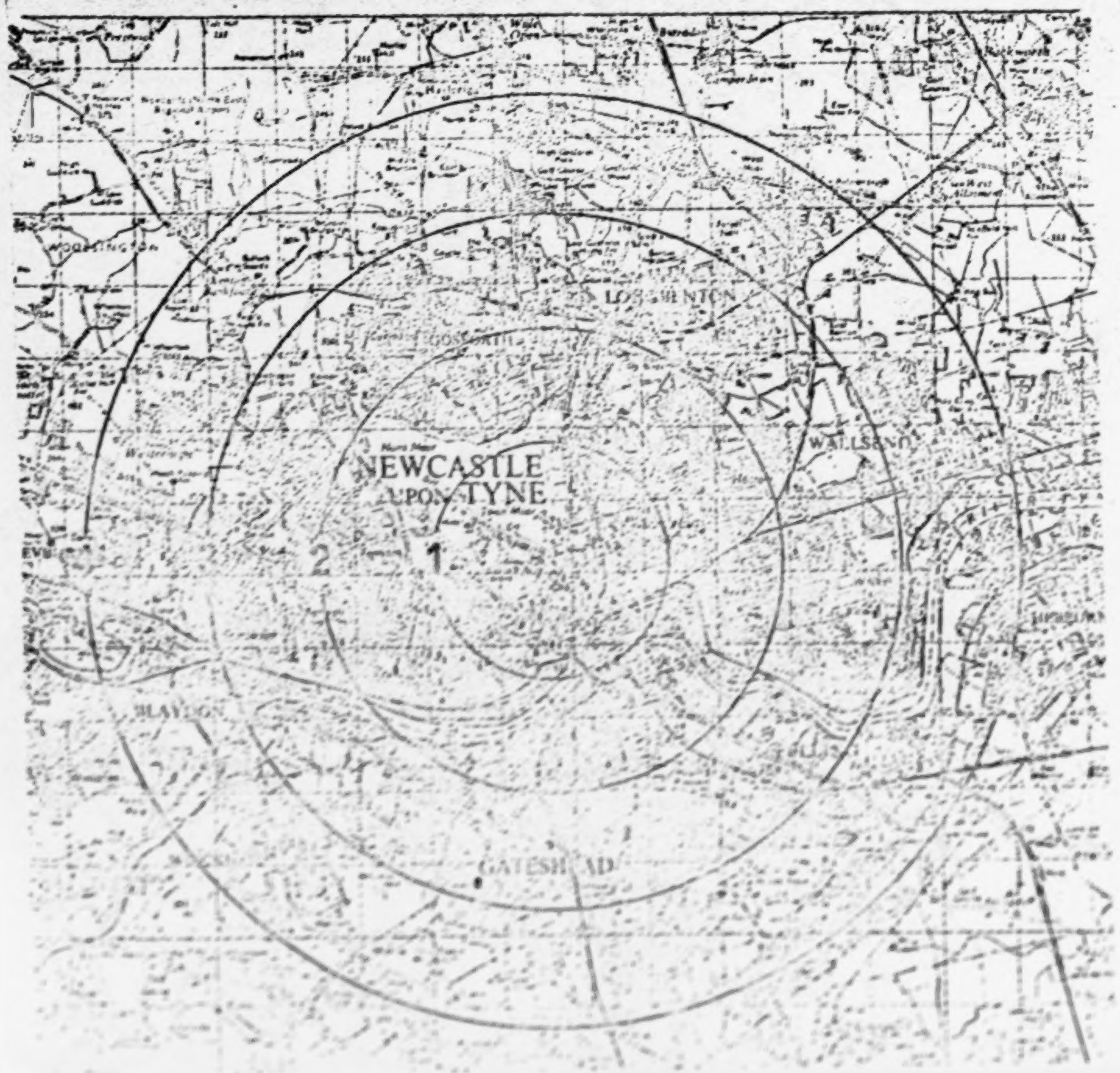
....

18. Where are you going to when you leave the library?

....

Note. For both questions, if within University Campus, please give name of building and floor in space indicated.

If outside Campus, mark on map below 'A' (where you came from) and 'B' (where you are going to): if outside map area, mark 'A' or 'B' outside outer ring.



Reverse

TIME IN

TIM

UNIVERSITY OF NEWCASTLE
LIBRARY SURVEY

IMPORTANT. Please place a TICK(✓) in BOXES where the answer is YES. Leave all other boxes BLANK

ANSWER either A or B or C

Sex? M.F.

A. Undergraduate?(incl.B.Ed) ☐ 1. Year 1 2 3 4 5 6 7 - Course ....
Postgraduate Instructional Course? ☐ 2. please ring as appropriate

B. Research Student? - - - ☐ 3. Year of Research 1 2 3 4 Dept....

C. Academic Staff? - - - ☐ 4. Dept. ....
Other? - - - - - ☐ 5. Please specify ....

TYPE(S) OF USE - THIS VISIT ONLY

Borrowing Books? - ☐ 6.
Returning Books? - ☐ 7.
Consulting Books? - ☐ 8.
Consulting Periodicals? ☐ 9.

Consulting Library Staff? - ☐
Using Catalogue? - - - ☐
Place to work? - - - ☐
Copying Service? - - - ☐
Other? - - - - ☐

Which sections of the library have you used for consultation this visit
In the following list underline Area & Subject as applicable.

IGNORE THIS QUESTION IN THE CASE OF DEPARTMENTAL SURVEYS.

AREA	SUBJECT
GROUND FLOOR	Philosophy, Psychology, Religion, Arch Language, Literature.
GROUND FLOOR EXTENSION	Social Sciences, History, Blue Books.
ARTS READING ROOM	
REFERENCE ROOM	
PERIODICALS	
BIBLIOGRAPHY ROOM	
FIRST FLOOR STACK	Law, Fine Arts, Music.
SECOND FLOOR STACK	Education, Geography.
THIRD FLOOR STACK	General Science Periodicals.
THIRD FLOOR EXTENSION	General Science Books, Maths, Physical Geology, Life Sciences.
FOURTH FLOOR EXTENSION	Engineering, Agriculture.
FIFTH FLOOR EXTENSION	Medicine.

How many times have you visited this library previously today? ......

ANNEX 5

Obverse

TIME IN	TIME OUT

P.E.B.U.L. SURVEY

1. How many times have you visited this library previously today? ....

2. How many items of library stock (i.e. books, periodicals, etc) have you used in the library this visit? ....

P.T.O.

Reverse

STATUS
Place a tick (✓) where the answer is YES.

3. Undergraduate?(inc. B.Ed)

Obverse

TIME IN

TIME OUT

P.E.B.U.L. SURVEY

1. How many times have you visited this library previously today? ....

2. How many items of library stock (i.e. books, periodicals, etc) have you used in the library this visit? ....

P.T.O.

Reverse

STATUS
Place a tick (✓) where the answer is YES.

3. Undergraduate?(inc. B.Ed)
   Postgraduate course? ☐
   Research Student? ☐
   Academic Staff? ☐
   Other? ☐
   Please specify .....

4. Course or Department

   ....

5. Year of study or research (students only): ring as appropriate

   1 2 3 4 5 6 7 8

P.T.O.

ANNEX 6

P.E.B.U.L. TERM-TIME 7-DAY ACTIVITY SURVEY

PLEASE WRITE NUMBERS ONLY IN THIS MARGIN

Please return completed questionnaire by 30 Nov. 1966
to W.E.M. Morris, University Science Labs., Durham.

BLOCK LETTERS PLEASE
Name ....
Dept. ....

All questions refer to activities IN THE LAST SEVEN DAYS whether these were typical or not. Another survey will cover a week in a vacation.

NOTES	In the last 7 days:	
Include lectures, seminars, tutorials, practicals, etc. and hours reading students' work.	How many hours did you spend teaching?	A)......
The number that should have been present.	How many different students involved?	B)......
Rough estimate, including all non-recreational reading of words, music, maps, graphs, etc.	What percentage of the rest of your working time was spent reading?	C)......

In the last seven days, how much time did you spend in the following libraries, and how many books in your possession during that time were borrowed from them. Please include periodicals, pamphlets, etc., but exclude any purely recreational reading. Leave blank any box with nil return.

LIBRARY

Durham University Library:	Palace Green	D) hours	E) books
	Oriental	F) hours	G) books
	Science	H) hours	I) books

P.E.B.U.L. TERM-TIME 7-DAY ACTIVITY SURVEY

PLEASE
WRITE
NUMBERS
ONLY
IN THIS
MARGIN

Please return completed questionnaire by 30 Nov. 1966
to W.E.M. Morris, University Science Labs., Durham.

BLOCK LETTERS PLEASE

Name ....

Dept ....

All questions refer to activities IN THE LAST SEVEN DAYS whether these were typical or not. Another survey will cover a week in a vacation.

NOTES	In the last 7 days:	
Include lectures, seminars, tutorials, practicals, etc. and hours reading students' work.	How many hours did you spend teaching?	A)......
The number that should have been present.	How many different students involved?	B)......
Rough estimate, including all non-recreational reading of words, music, maps, graphs, etc.	What percentage of the rest of your working time was spent reading?	C)......

In the last seven days, how much time did you spend in the following libraries, and how many books in your possession during that time were borrowed from them. Please include periodicals, pamphlets, etc., but exclude any purely recreational reading. Leave blank any box with nil return.

LIBRARY			
Durham University Library:	Palace Green	D) hours	E) books
	Oriental	F) hours	G) books
	Science	H) hours	I) books
Inter-Library Loan		☒	J) books
Faculty, Department or Chapter Library		K) hours	L) books
College Library		M) hours	N) books
Durham County Library		P) hours	Q) books
Colleagues' collections		☒	R) books
Libraries outside Durham City		S) hours	T) books

Please outline your main sources of professional information, and add any further comments or suggestions you may care to make:

Continue overleaf if necessary

To all members of the
University Academic Staff.

ANNEX 7

P.E.B.U.L. VACATION WORKING WEEK AND INFORMATION SOURCE SURVEY

Please return completed questionnaire by
1st May 1967 to:
W.E.M. Morris, University Science Labs. Durham

Name ....
Dept. ....

Questions A & B refer to activities in any SEVEN DAY working period during the Easter vacation. Question C is a general one, not relating to the Easter vacation.

A. What percentage of your working time was spent reading? (include all non-recreational reading of words, music, maps, graphs, etc.)

A ....%

B. How much time did you spend in the following libraries, and how many books in your possession during that time were borrowed from them? Please include periodicals, pamphlets, etc., but exclude any purely recreational reading. Leave blank any box with a NIL return.

Durham University Library	Palace Green	hours	books
	Oriental	hours	books
	Science	hours	books
Inter-Library Loan (I.L.L.)			books
Faculty, Department, or Chapter Library		hours	books
College Library (which? ....)		hours	books
Durham County Library		hours	books
Colleagues collections			books
Libraries outside Durham City (Please specify below)		hours	books
Other libraries, Please specify (name only - no other details)	....		

C. Please place in order of importance for your work the following sources of information. You may add to the list if you wish.
Place 1. against the most important source,
2. against the next most important, and so on.

1st May 1967 to:

W.E.M. Morris, University Science Labs. Durham

Dept. ....

Questions A & B refer to activities in any SEVEN DAY working period during the Easter vacation. Question C is a general one, not relating to the Easter vacation.

A. What percentage of your working time was spent reading? (include all non-recreational reading of words, music, maps, graphs, etc.)

A ....%

B. How much time did you spend in the following libraries, and how many books in your possession during that time were borrowed from them? Please include periodicals, pamphlets, etc., but exclude any purely recreational reading. Leave blank any box with a NIL return.

Durham University Library	Palace Green	hours	books
	Oriental	hours	books
	Science	hours	books
Inter-Library Loan (I.L.L.)		☒	books
Faculty, Department, or Chapter Library		hours	books
College Library (which? ....)		hours	books
Durham County Library		hours	books
Colleagues collections		☒	books
Libraries outside Durham City (Please specify below)		hours	books
Other libraries, Please specify (name only - no other details)	....		

C. Please place in order of importance for your work the following sources of information. You may add to the list if you wish.
Place 1. against the most important source,
2. against the next most important, and so on.
Leave BLANK any source not used.

This question does not refer only to the seven day period.

Personal Collection		
Durham University Libraries - excluding I.L.L. (inc. Dept. & College)		
Other libraries (including privately owned collections)	involving travelling	
	not involving travelling (inc. I.L.L.)	
Field Work, Lab. work, Surveys; visits to museums, archives, works etc.		
Conferences, Seminars, Conversations with Colleagues		
Current newspapers, T.V., Radio		
Other sources (please specify)		

ANNEX 8

THE UNIVERSITY OF NEWCASTLE UPON TYNE

QUESTIONNAIRE

1. Name:________________________ Date of birth:____________

2. Faculty:____________________ Tutor: ____________________

Main subjects: ______________________________________

3. In which year did you matriculate at the University?

1963	1	
1964	2	
1965	3	(ring no. as appropriate)
1966	4	
1967	5	

4. Residence in Newcastle: Hall of residence (state which):____________
Lodgings or home (state road and postal district):
____

Home town or village:____________ County:____________

5. How long (to the nearest five minutes) does it normally take you to get from your hall or lodgings to the University?

6. Which libraries in or near Newcastle have you used, for whatever purpose, **this session** (i.e. since October 1967)?

University Library (UL)	1	
Department Library (DL) State which ones:	2	
Hall of residence library (HR)	3	(ring nos. as appropriate)
Newcastle City Libraries: Central Library (in New Bridge Street) (CC)	4	
Newcastle City Libraries: Branch Library(CB)	5	
Other (e.g. Wallsend, Newburn, etc.) State which:	6	

7. Please record for each library your average frequency of use this session by ticking appropriate cells.

Frequency of use

Library	Every day	2 or 3 times a week	Weekly	Once or twice a month	Less often
UL					
DL					
HR					
CC					
CB					
Other					

8. Please list briefly all the books you have on loan at present, from whatever library or on whatever subject:

Brief author & title	Classification number	Library from which borrowed (use coding as above in q. 6 & 7)

9. If you want a **specific book** (whose author and title you already know) in connection with your course work, which library do you normally try first?

UL 1 HR 3 CB 5 (ring no. as appropriate)
DL 2 CC 4 Other 6
Specify:

10. If it is not available in that library, do you normally try another library?

YES/NO

11. If you try another library or libraries, state which:

UL 1 HR 3 CB 5 (ring no. as appropriate)
DL 2 CC 4 Other 6
Specify:

12. Of the last three books you have looked for in the **University Library**, how many have you found? (Tick cells when answer is 'yes')

	Was University Library the first library you tried for this book?	Found in University Library	Found in catalogue, but not on shelves	Not found in catalogue or assumed not to be in University Library
1				
2				
3				

13. Of the last three books you have looked for in **your Departmental Library**, how many have you found?

	Was Departmental Library the first library you tried for this book?	Found in Dept. Library	Found in catalogue, but not on shelves	Not found in catalogue or assumed not to be in Departmental Library
1				
2				
3				

14. Have you ever tried to obtain a book from **another Departmental Library** through the University Library? YES/NO

15. Have you ever tried, while at the University (whether in term or vacation) to obtain a book on inter-library loan from another library? YES/NO

16. If you want to find a book **on a specific subject** related to your course, which library do you try first, assuming you do not have a particular book already in mind?

UL	1	HR	3	CB	5	(ring no. as appropriate)
DL	2	CC	4	Other	6	
				State which:		

17. If you try another library or libraries, state which:

UL	1	HR	3	CB	5	(ring no. as appropriate)
DL	2	CC	4	Other	6	
				State which:		

18. When looking for specific books, do you find that books you are not specifically looking for catch your interest?

Library	Of direct relevance to your course		Not of direct relevance	
	Commonly	Occasionally	Commonly	Occasionally
UL				
DL				
HR				
CC				
CB				
Other (specify)				

19. How (briefly) do you set about finding books on a given subject in the University Library assuming you do not already know the authors and titles? (e.g. by using subject catalogue, going straight to shelves, etc.)

____

____

____

20. If you want a place to work quietly, where do you go **from preference**?

UL	1	Hall or lodgings	3	(ring no. as appropriate)
DL	2	Other	4	
		Specify:		

21. Why (briefly) do you prefer to work there? (e.g. more room, better access to other material, close to department, more comfortable, etc.)

22. At what times of day did you use the University Library or your Departmental Library **last week** (whether this was typical or not)? (Tick cells as applicable)

	9-1		1-5		5-9	
	UL	DL	UL	DL	UL	DL
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						
Saturday						

23. For what purposes have you used it **this session**?

	UL	DL
Borrowing or returning a book		
To check if the Library has a given book		
To look for books on a given subject		
As a place to work with your own books or to write		
Consultation of library material: books		
periodicals		
Requesting a book from another library		
To satisfy a reference query (e.g. to look up a census report, or check an address)		
To use the copying or photographic service		
Other (please specify)		

24. Please outline briefly how you spent yesterday (or the last day not a Saturday or Sunday), whether or not it was a typical day. (For activities unconnected with your course, state 'personal' and leave Location uncompleted)

Time (approx.) from	to	Activity	Location

25. What difficulties or disadvantages do you find in using your Departmental Library?

26. And what advantages?

27. What difficulties or disadvantages do you find in using the University Library?

28. And what advantages?

29. If in difficulty when using the University Library, do you consult the Library staff?

Frequently	1	Very rarely	3	(ring no.
Occasionally	2	Never	4	as appropriate)

Date ____________________

ANNEX 9

UNIVERSITY OF DURHAM

LIBRARY QUESTIONNAIRE - UNDERGRADUATES

Date of Interview.

1. Year and Course (code)

2. In the past seven days, ending (date)............, how many hours have you spent on the following activities?

(a) Attending lectures ....

(b) Doing Practical work ....

(c) Attending seminars, tutorials, discussions etc. ....

(d) Visiting the University Library - Palace Green ....

Science ....

Oriental ....

(e) Visiting Department Library ....

which? ....

(f) Visiting College Library ....

(g) Visiting other Libraries ....

which? ....

(h) Acquiring information from other sources? ....

(e.g. Radio, T.V., other students' notes)

which sources? ....

(j) Doing other Private Study ....

(k) Visiting bookshops (to buy or browse) ....

3. For Yesterday give details of time spent on

Private Study

a) Reading - (i) Curricular Reading ....

(ii) Extra Reading ....

(iii) Recreational Reading ....

LIBRARY QUESTIONNAIRE - UNDERGRADUATES

Date of Interview.

1. Year and Course (code)

2. In the past seven days, ending (date)..........., how many hours have you spent on the following activities?

(a) Attending lectures ....
(b) Doing Practical work ....
(c) Attending seminars, tutorials, discussions etc. ....
(d) Visiting the University Library - Palace Green ....
Science ....
Oriental ....
(e) Visiting Department Library ....
which? ....
(f) Visiting College Library ....
(g) Visiting other Libraries ....
which? ....
(h) Acquiring information from other sources? ....
(e.g. Radio, T.V., other students' notes)
which sources? ....
(j) Doing other Private Study ....
(k) Visiting bookshops (to buy or browse) ....

3. For Yesterday give details of time spent on Private Study

a) Reading - (i) Curricular Reading ....
(ii) Extra Reading ....
(iii) Recreational Reading ....

b) Writing - (i) Notes for own use ....
(ii) Essays, practicals etc., for handing in ....

c) Informal discussions out of class ....
d) Other ....
Please specify ....

cont/d...

4. Please give the following information in respect of these libraries.

Library	Date of last visit	Approx. how many times visited this term?
Palace Green Science Oriental		
Department College Other		

5. How many books have you now got which were borrowed from libraries?

(a) Palace Green ....
(b) Science ....
(c) Oriental ....
(d) Department ....
(e) College ....
(f) Other ....
which library? ....

6. How many borrowed library books did you use
a) Yesterday? ....
b) in the past 7 days? ... .

7. Certain library books have restrictions placed on their use. How many have you consulted during the past seven days which are
a) Confined to the Library? ....
b) Allowed out overnight only? ....

8. Have you a borrowing ticket for

Write 1 for YES and 0 for NO when answering this question

a) the University Library? ....
b) the County Library? ....
c) your Local Public Library? ....
d) another University Library? ....

9. a) How many books have you bought this term? ....
where from? ....
b) How many books have you sold this term? ....

CHAPTER 7

A CURRENT-AWARENESS SERVICE FOR SOCIAL SCIENTISTS

1. Introduction

In Chapter 3 a method was given for finding those values of library activities which were implicit in the decisions of the university committee system. We also discussed how the values, once made explicit, could be used to assess changes in the technology of providing various library services. Throughout that chapter there was an emphasis on the "warehousing" activities of the library. In this chapter the possibility of extending user-services in a particular direction is examined.

It may be the case that users are not aware of the potential value of user-services by librarians because these services have been at too low a level for users to have had a chance to sample them. If more time were devoted to these services by graduate librarians, the users' valuation of the service might increase so that the value per hour of user services would also increase. (In economic jargon: the second order conditions for optimisation might not have been met previously.)

The hypothesis is that an intensive information service will be of such value that a shift of university resources from other activities towards information services will leave everybody better off. The testing of such a hypothesis in a non-market situation is very difficult and all we have done is to provide some pointers.

Since there was no such service available within the university at the start of the project we had to provide one before we could assess it. We chose to provide it to some of the social science departments, and the choice of these rather than other departments was made for several reasons. First, the literature is unanimous in showing that such a service is useful (if seldom provided) for natural scientists, but either of little use or difficult to assess for those working in the humanities (de Hart, 1964). A study of the half-way house of social science might provide some reasons for these different results. Second, since one of the principal investigators is an economist, he would be close to the experiment and readily available for consultation or to thwart any excessive demands that might be made on the service by individual colleagues. (Also, since he thought the service would be beneficial he wanted his share.) Third, the evaluation would involve concepts that would be more familiar to social scientists so there would be less risk of survey questions being misinterpreted.

2. Description

Work was commenced on the service in March 1967. The Information Officer was a graduate economist working for two days a week, at first, and at this stage the service was given to only 11 members of staff. These consisted of the whole of the Department of Economics and the Professor of Economic History. As the information officer's initial contract was only for a four month period, it was imperative that some information should be provided as quickly as possible, which was the main reason for offering the service to only a few members of staff. The pilot project of the SDI system at North Western University also commenced with 11 members of staff in the social sciences with a view to expanding later. (Janda and Rader, 1967.)

Initially the contents pages of journals which had arrived in the University Library during the previous week were Xeroxed and circulated to members of staff. When approached most publishers gave permission to make multiple copies of the contents pages of their journals for this purpose.

Each member of staff was interviewed and asked his research and teaching interests. The first reactions to the proposed introduction of the service contained doubts as to whether such a service would help academics. Other information officers also find this reaction common. Some members of staff, especially those who were not engaged in a specific topic of research, found it difficult to define their interests. However, personal profiles were built up on the basis of these answers. It was necessary throughout the service to keep revising these profiles to take account of new interests, research projects and lecture courses and to re-define some of the original topics. Discussions in the Common Room proved to be the most fruitful source of these adjustments. The subject of one person's Ph.D. thesis was revealed in this way. On being interviewed he had not mentioned that he was working for a Ph.D.

As soon as profiles had been drawn up for a few members of staff, it was possible to begin a service on an individual basis. The contents pages of periodicals were scanned as they arrived in the University Library. A "Master Card" was made for each issue of a periodical. The author and title of each article thought to be of interest to someone in the Department were noted on this card. From this Master Card, individual references were sent. These consisted of Author, Title, Periodical, Issue and Location.

The initials of the person to whom a reference to an article was sent were placed on the Master Card. At first each person's references were placed on a sheet of paper so as to form a bulletin which was sent out weekly. It was soon learned that some members of staff kept a card index of articles and books of interest to them and so future references were sent on index cards. The 5" x 3" size was used except where members of staff requested another size to fit their bibliographies. This minor change was very well received.

Part of a notice board in a central position was set aside for the use of the information officer. A weekly list of the recent accessions to the University Library was placed on the notice board. The value of this was expected to be relatively low, since the lists consisted mainly of books which the Department had ordered for the library in the first place. By using this list, the departmental catalogue of economics books held at the University Library was kept up to date.

For the first few months after the introduction of individual references, Xerox copies of the contents pages of journals were placed on the notice board. Throughout the service, the notice board has been regarded more as a safety net than a major means of disseminating information. This opinion was reinforced by comments such as "I never look at notice boards" and "Notice boards are for students". However, on one occasion, a member of staff did request further details of a publication which he said he had seen on the notice board. It was discovered that he had already received full details on an individual card.

The service was extended to include details of recently published books, which were obtained from the B.N.B., and details of Government Publications, obtained from H.M.S.O. Daily Lists. The information officer paid regular visits to the Science & Oriental Sections of the University Library, the Geography Department Library and the Durham County Library, as well as the Arts/Social Science Library.

Lists of recently published books were placed on the notice board about once a fortnight. These included books of general interest to staff and students and books on topics in which no one had expressed a particular interest. A list of periodicals taken at Newcastle University Library (the nearest other university to Durham: 15 miles), but not in Durham, was also placed on the notice board, together with a list of statistical publications held at Durham, including frequency and expected time of arrival. These lists have some value, but would be used infrequently.

7.4

In the Summer Vacation, 1967, the service was extended to include the rest of the Economic History Department (3 members of staff) and some of the Business School. During the Autumn Term 1967 more members of staff from the Business School and some from the Politics Department were added, making a total of 29.

By increasing the recipients gradually, the extra work involved was absorbed by using the time gained through increased efficiency. It was expected that, once the service had been set up with certain fixed costs in terms of the information officer's time, it would be possible to include extra people in the service at a constant and low marginal cost. However, this did not prove to be the case. When the three extra members of staff in the Economic History Department were added, the extra time taken was negligible. This was largely because it was not necessary to look at any extra journals. Expanding the service to the Business School meant starting to scan Management journals for the first person. But when the next person in the Business School was included, scanning had to commence in the Operations Research and Computer journals. When another two people were added, it was necessary to scan the Psychology journals. Our expectations about fixed and marginal costs broke down at this point. There was no constant marginal cost for including an extra person in the service, even if some of that person's colleagues were already included. This was further borne out by the inclusion of members of Staff in the Politics Department. The extra work involved in providing the service for the lecturer in the Politics of the Middle East was small, as the service was already being provided for a lecturer interested in the Economics of the Middle East. However, the extra work involved in providing the service for the Political Philosophers was considerable. Although these large differences were found in this experimental, small-scale service, a constant relationship might be found if the departments were larger.

The rapid expansion in the number of journals which it was necessary to scan resulted in extra time being needed by the information officer. As from November 1967 3 days per week were spent on the service.

An attempt was made to persuade members of staff to use the resources of libraries outside Durham. A number of visits were made by the information officer to Newcastle Public Library which holds far more management and accounting journals than Durham. Details of articles in journals taken there but not in Durham were sent to members of staff in the normal way. This produced little enthusiasm and, as far as could be ascertained, no response in the form of visits by users of the service.

Another attempt was made to gain references to articles and books which were not available in Durham by using bibliographies and indexing journals. The main problem here was that most members of staff had not defined their interests in sufficient detail to make the use of bibliographic aids practical. The time lag between the appearance of the primary and secondary journals made the information less "current" and consequently the members of staff already knew about a higher proportion of this information. There seemed to be no enthusiasm at this stage for requesting items on Inter-Library Loan.

After the service had been operating for a year, users were interviewed to find out how the service could be improved. The survey also allowed us to try out some questions which we hoped would aid in the final evaluation of the service.

3. Pilot Evaluation

Members of staff were interviewed in April 1968 to try to find the value to them of the service they had been receiving over the past months. A total of 29 had received the service: 10 from the Department of Economics who had received the service for 12 months, 4 from Economic History (8 months), 8 from the Business School (6 months) and 7 from Politics (5 months).

Users of the service were asked their interests and were provided with cards containing references to articles in current journals in the University libraries, recent acquisitions at Durham and Newcastle University libraries and at the County Library, and recent publications, wherever these seemed relevant. Xerox copies of contents pages were put on the Economics notice board, and provided direct to the economists in some cases. Care was taken to be present at the communal tea-break for feed-back and to liaise between departments and the library staff.

By building up gently to 29 people the time taken for the service was kept to three days each week.

The Survey

Of the 29 people who received the service, 27 were interviewed. Questions referring to changes in activities before and after the service could not apply to 2 people who arrived after the service started. There were also 2 people who found it difficult to answer many questions as they had received little from the service.

1. In your opinion how often should current awareness information be sent out?

7.6

Daily	
Twice a week	
Weekly	11
Fortnightly	8
Monthly	7
Every 6 months	

Comment: Before this survey information was sent out weekly. Topicality does not seem extremely important. The choice seemed to be between making the arrival of the information a daily routine, which would be expensive, and making the arrival into an event. After the survey information was sent to individuals at the intervals they requested.

2. Do you keep a personal bibliography?
YES 25 NO 2

3. Did you before the service started?
YES 22 NO 4

Comment: (One person started an academic career after the service started and did not answer this question.) Two people began a bibliography after the service started.

4. Does the current awareness service:

(a) increase the size of your bibliography?
22

(b) save time in compiling your bibliography?
19

(c) duplicate cards already in your bibliography?
7

Comment: We assume that the difference between (a) and (b) was due to a high proportion of irrelevant items which were filed but not expected to be useful by these three people.

5. Frequency of use of libraries at the time of the interviews:

	More than once a week	More than once a month	Once month or less	Never
Arts/Soc.Sci.	8	12	7	-
Science	-	4	11	12
Oriental	3	1	-	23
Geography Dept.	1	-	6	20
Durham County	-	3	10	14
Other	1	1	11	14

Comment: By comparing this with a similar table of their use of libraries before the service started, it was found that the service resulted in no change for 18 people, 5 used libraries more often, 2 used non-University libraries less often, and 2 started using libraries they did not use before. It is interesting that the off-subject libraries were those used more often, Oriental and Science by Economists and Economic Historians. (Actually there was a 7½% increase in use of libraries after the service.)

6. Do you think the way you use libraries has changed since the service started?
NO 10; YES 15, of which:

1 spends more time in libraries, 3 less time
13 find what they want to read more quickly
5 use periodical indexes less often, 1 differently
2 spend more time browsing, 6 less time
3 consult library staff less often, 1 differently

Comment: The three people who spent either more time in libraries or more time browsing were amongst those who visited libraries more frequently.

7. Please place the following services in order of value to you for:

(a) your teaching purposes
(b) your research

(Use numbers 1 to 5, 1 for the most valuable, etc.)

	Teaching	Research
Index cards of journal articles and recent acquisitions	1	1
Index cards of recent publications not in the library	3	2
Index cards of Government publications	4	4
Xerox sheets of contents pages of new journals	2	3
The material on the notice board	5	5

Comment: Index cards of journal articles were the most valued part of the service. For the Economists this represented a change of opinion. When 9 were interviewed after the first three months, 4 rated contents pages higher than index cards of journal articles, 4 rated them equal, only 1 preferred the index cards of journal articles. Several felt that the notice boards were useful for students.

8. What proportion of the information you have received is of use to you for the following purposes?

	Econ.	Ec.Hist.	Bus.Sch.	Pol.	All
No. of people	9	4	8	4	25
	%	%	%	%	%
Teaching	35	26	35	3	33
Research	35	69	49	86	46
General Interest	20	5	14	5	15
Administrative liaison with library	10	-	2	6	6
Other	-	-	-	-	-

Comment: A current awareness service is of more use for research than for teaching purposes. However, as two members of the Business School and one members of Politics did not teach, the difference between these uses was less than appears from the figures.

9. In what form do you prefer to receive the information?

Xerox copies of contents pages	3
Index cards	23
Notice board	0

10. What proportion of the information you have received falls into each of the following categories:

(a) Already knew about article or book before receiving the information

(b) Did not know about article or book but have acted as follows:

1. Have read article or ordered book
2. Intend to read article or book (i.e. it is relevant to what you are doing now)
3. Have filed information for future reference (i.e. it may be relevant to what you hope to be doing some time in the future)
4. Irrelevant

	Econ.	Ec.Hist.	Bus.Sch.	Pol.	All
Numbers	9	4	7	5	25
	%	%	%	%	%
a	23	12	14	34	20
b1	14	41	13	5	16
b2	23	11	33	15	24
b3	33	26	35	25	32
b4	7	10	5	21	8

Comment: The total of a + b1 + b2 seems an index of relevance. The proportion of information that recipients already knew about before receiving it (p) is related to the frequency of visits to their principal library (f).

(f)	(p)	
more than once a week	29%	(10 people)
more than once a month	21%	(8 people)
once a month or less	9%	(5 people)

7.10

11. Which of the following choices do you think would be of most value to your work?

    (a) A personal research assistant for 5 days per year

    (b) The present current awareness service

    (c) One four-day visit per year to a London or Oxford Library, OR one six-day visit to the National Lending Library (second class rail and reasonable hotel bill paid in each case)

    (d) An additional book grant of £15

	Econ.	Ec.Hist.	Bus.Sch.	Pol.	All
(a)	1	1	-	1	3
(b)	8	1	8	3	20
(c)	-	2	-	2	4
(d)	-	-	-	-	-

Comment: There is a clear preference for the current awareness service. It is interesting that nobody wanted more books. The choices were of equal cost, £20 estimate, being the cost of the service per person per **year** at the moment. (We allowed £5 for processing £15 worth of books.) The Economists and Economic Historians had some comments to make on the choices. Each choice had a different time horizon and so was difficult to compare because time preference had to be taken into account. Current awareness is a means to an end; it tells you where. A research assistant would find the material. Choice (a) and choice (b) are complements rather than substitutes: if the value of (a) equalled the value of (b), the value of (a) + (b) would be more than doubled. There are externalities in a collection of books: more use by one person need not entail less use by another. The value of £150 worth of books for the ten members of Economics would be more than ten times £15. The final questionnaire was planned to take this into account.

Question 11 did not bring out the impression gained from the interviews that Economic History liked the service but liked the choices even more, but the majority of Politics got little from the service. Question 10 shows this better: b1 + b2 = 52% for Economic History but only 20% for Politics.

Was this simply because the service had not been going long enough for Politics? This will show up with time. Is it support for the Faradane view: an information officer should be trained in the same discipline as the recipients of the information? If this were so, one would expect the service to be less useful to Economic History and to the operational researchers and industrial psychologists in the Business School.

Is it the case that Politics is a qualitatively different discipline from the others? Certainly this is true of Political Philosophy, but not necessarily so for the Politics of the Middle East nor for Political Institutions. Our surveys of library use and of the term-time and vacation activities of academic staff show a remarkable degree of similarity between Politics and Economics.

4. Changes in the Service

The following changes in the service were made in response to the results. Information had been sent out weekly. Some members of staff said they thought information should be sent out fortnightly or monthly. Future information was sent to each individual at the frequency he had specified.

Priority was given to collecting and distributing references to articles in current periodicals. Instead of scanning the HMSO Daily Lists for details of Government Publications, the Monthly List was used. This saved time not only because the number of bulletins was greatly reduced, but also because the Monthly Lists are indexed and classified to a greater extent than the Daily Lists.

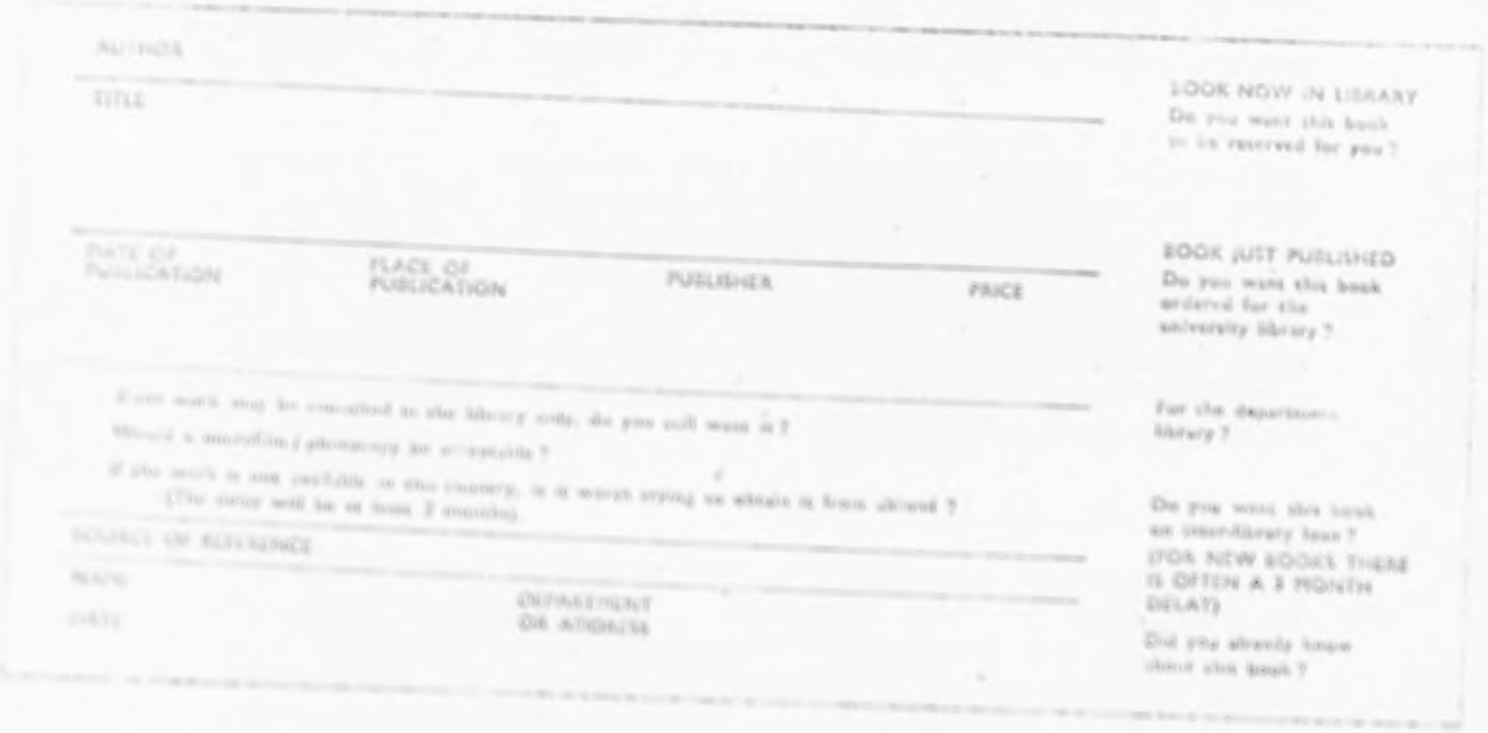
The notice board was used much more with students in mind. Xerox sheets of the contents pages of new journals were no longer placed on the notice board. Nobody made any comments about this change. This, together with the preference for individual cards expressed in the answers to the questionnaire, was interesting because in the early stages of the service most members of staff said they preferred the Xeroxed contents pages.

Two members of staff in the Politics Department said that they gained nothing from the service and felt it to be a waste of time. These were dropped from the service and it was then possible to include the whole of the Business School. Other inclusions and omissions occurred due to staff turnover at the end of the academic year.

In October 1968 the service was extended to include the provision of Xerox copies of articles on request, provision of books and articles on Inter-Library Loan and the ordering of books for the Departmental and University Libraries. Printed cards were used for this purpose - see below. They had been specially designed by members of the FEBUL Team. Members of staff were asked to answer the question on the form and return the carbonised slip, retaining a card

7.12

(5" x 3") with the reference on it.



AUTHOR

TITLE

BOOK NOW IN LIBRARY
Do you want this book to be reserved for you?

DATE OF PUBLICATION
PLACE OF PUBLICATION
PUBLISHER
PRICE

BOOK JUST PUBLISHED
Do you want this book ordered for the university library?

If the work may be consulted in the library only, do you still want it?
Would a microfilm / photocopy be acceptable?
If the work is not available in this country, is it worth trying to obtain it from abroad?
(The delay will be at least 2 months).

For the departmental library?

SOURCE OF REFERENCE

NAME

DATE

DEPARTMENT OR ADDRESS

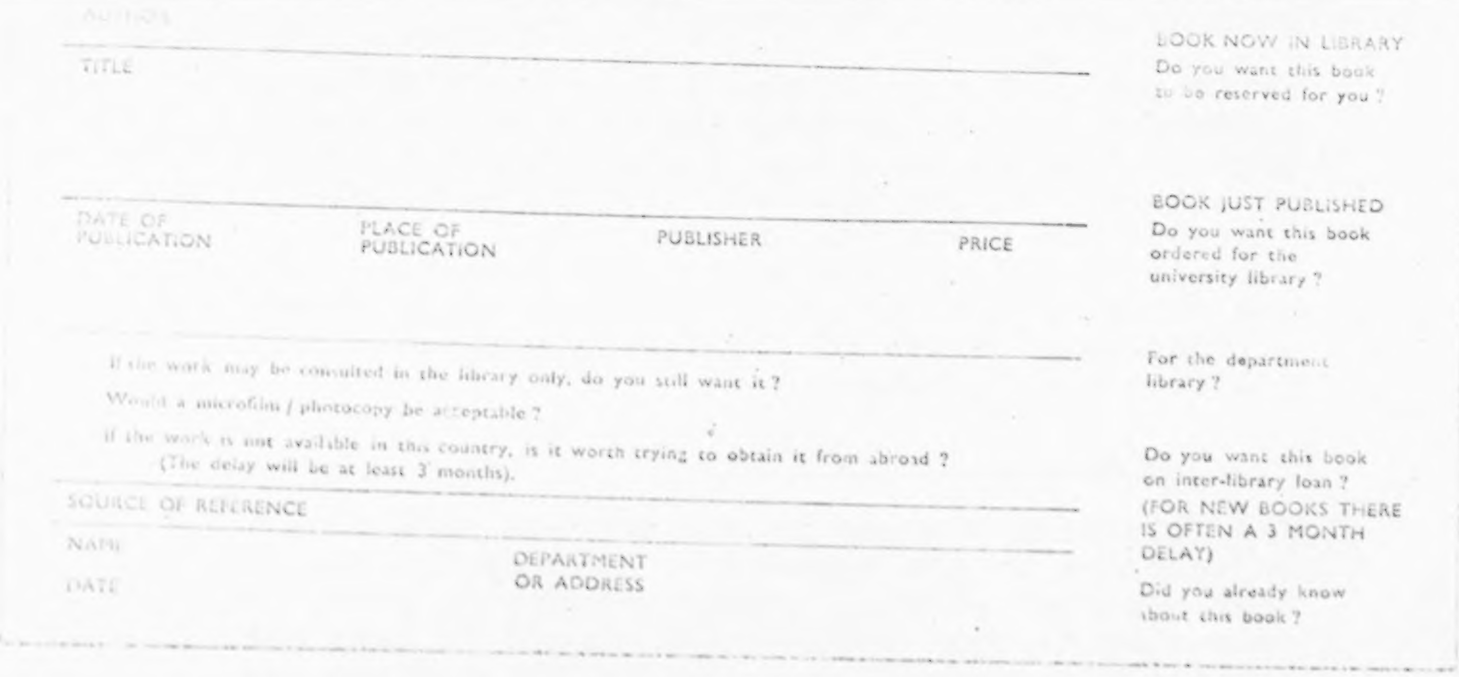
Do you want this book on inter-library loan?
(FOR NEW BOOKS THERE IS OFTEN A 3 MONTH DELAY)

Did you already know about this book?

Only one of the four members of staff who had been receiving larger cards opted to continue receiving them without the benefit of the new aspects of the service.

As far as the information officer was concerned, the new cards simplified the distribution of information, since it was no longer necessary to prepare a master card for each issue of a journal. As each journal was checked for relevant information, it was simply ticked on a table. Time saved in this way was absorbed by filing the returned slips, ordering books and obtaining Inter-Library Loans and Xerox copies of articles.

It was hoped that this additional aspect of the service would tempt members of staff to make greater use of the Inter-Library Loan service and the card was designed to give a minimum of clerical work when books or articles were requested on Inter-Library Loan. During this academic year references to articles and books not in Durham University Library were raised from journals



AUTHOR

TITLE

DATE OF PUBLICATION
PLACE OF PUBLICATION
PUBLISHER
PRICE

If the work may be consulted in the library only, do you still want it ?
Would a microfilm / photocopy be acceptable ?
If the work is not available in this country, is it worth trying to obtain it from abroad ?
(The delay will be at least 3 months).

SOURCE OF REFERENCE
NAME
DEPARTMENT OR ADDRESS
DATE

BOOK NOW IN LIBRARY
Do you want this book to be reserved for you ?

BOOK JUST PUBLISHED
Do you want this book ordered for the university library ?

For the department library ?

Do you want this book on inter-library loan ?
(FOR NEW BOOKS THERE IS OFTEN A 3 MONTH DELAY)

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It was hoped that this additional aspect of the service would tempt members of staff to make greater use of the Inter-Library Loan service and the card was designed to give a minimum of clerical work when books or articles were requested on Inter-Library Loan. During this academic year references to articles and books not in Durham University Library were gained from journals taken by Newcastle University Library and from abstracting and indexing periodicals held at the National Lending Library. Some visits were made by the information officer to Newcastle University Library and the NLL for this purpose and on other occasions the secondary periodicals were themselves requested on ILL. On one occasion one issue of each of two indexing periodicals were obtained from the NLL. From these, 14 references were sent to one person and he requested 10 of these on ILL. However, this was an exception and in practice, few ILL's were requested as a result of the cards but a great number of requests were made for Xerox copies of articles and books to be ordered. These two aspects of the service involved clerical work and requests for Xerox copies of articles also needed the signature of the member of staff making the request. This latter delayed the provision of Xerox copies considerably in some cases. Some of these problems could be overcome by adjustments to the design of the cards on which the information is sent.

Although few ILL's were requested as a direct result of a reference sent on a card, several spontaneous requests for items on ILL were received. The extension of the service seemed to generate far more requests for information from recipients - or it may be that the service had been in existence for a longer peiod and confidence had been built up.

Three members of staff failed to return their slips. When approached, one of these indicated that he no longer wanted the service. Some other members of staff returned only a proportion of their slips.

5. Labour Costs and Outputs

The labour costs of providing the service were about £750 per annum, being the cost of a graduate working part-time. To this could be added various overheads (secretarial assistance, office, telephone, etc.), but since the costings are to be used for comparing the cost of an information officer with the users' opinions of the value of their own time saved, and since these opinions did not include any allowance for overheads, we too shall ignore them. In practice overhead costs were small; perhaps £100 per annum would be the figure.

Much of the work of providing the service fell conveniently into a routine fortnightly cycle. By the end of the project about 20 hours a fortnight were being spent by the information officer on administration, walking between libraries, informal discussions at coffee breaks and searching main sources - those tasks which did not depend greatly on the number of users of the service. The additional time needed for each additional user varied with the particular user but three factors were particularly important: new departments, new research fields and "learning by doing".

New departments involved an immediate increase in time because of walking distance and the importance of being present at a coffee break occasionally to enable profiles to be revised. Most users were reluctant to revise their own profiles spontaneously but were quite ready to do so informally in the common room in the course of conversation. For this reason some informal contact with users was essential. Where two departments used the same common room and contained users who were addicted to coffee or conversation the extra work was kept to a minimum.

Adding a new user whose research field was not already catered for involved about half again as much work as adding a new user whose fellow researchers were already users. Natural scientists may be surprised that a new user in an existing field should involve any appreciable extra work at all, but researchers in the social sciences seem to take both a broader and a more individual approach to their research. As a result, each additional user will put some demands on the information officer's time but new research topics will not often involve an entirely new range of journals to be searched.

Research fields are not sub-sets of departments. There were considerable overlaps between departments. This was to be expected between the Business School and other departments since the School is staffed by an inter-disciplinary team. However, there was also overlap between departments on Middle East topics, the employment of the disabled and so on.

The most marked effect on time needed per user was the experience of the information officer. In the first few months of the service one additional user working on a new topic involved 60-70 minutes of additional work, after a year's experience users working on new topics could be added with only 40-50 minutes of additional work. For new users working in fields already covered the time required was 40-50 minutes at the start of the service but only 20-30 minutes after a year's experience.

The measurable outputs of the service are given in the following tables. Table 1 shows the total number of items distributed, where an item is one reference on an index card or one photocopy of the contents page of a journal. 200 journals were searched, most of them regularly on arrival at the University libraries. The table is divided into the periods before and after the improvements in the service. The second and fourth columns are normalised to allow comparison between the time periods of different length and the departments with different numbers of people.

Table 1. Items distributed

	March 67 to September 68		Oct 68 to May 69	
	Total items	per person per month	Total items	per person per month
Economics	2533	13.3	1238	15.5
Ec. History	570	7.5	257	8.0
Politics	538	4.0	264	5.5
Business School	2250	14.2	1692	21.2
Total	5891	10.7	3451	14.4

Comparison of time periods shows that the flow of items per person per month increased for each department: the number of items sent to each person is small by comparison with research establishments, but during the period October-May most of the recipients will be spending most of their time on teaching or administration.

The response of recipients to the items sent during the last 8 months of the service is shown in Table 2. A reproduction of the cards sent is given on page 7.12. Users were asked to return the cards to the information officer marking the action they wished to be taken, or stating that the item was not relevant. The first row shows the number of cards that were returned, and row 2 expresses these as percentages of the third column of Table 1. Row 3 shows the percentages of those items returned of which the recipients were already aware. These percentages are very low and provide some justification for the current awareness service. Rows 4, 6 and 8 show the action taken in response to the cards. Their sum shows that 15% of the cards sent stimulated the recipient into taking further action other than filing the cards away or reading the articles in books in the university libraries, a high proportion. Rows 5, 7 and 9 are given to convey some idea of the work-load, which is small compared with the work involved in sending the cards in the first place, but increases the value of the service.

Table 2. Requests generated by cards, October 68 to May 69

	Econ.	Ec.Hist.	Pol.	Bus. Sc.	Total
1. No. of cards returned	1017	244	192	788	2241
2. Percentage of cards returned	82%	91%	73%	47%	62%
3. Percentage already known	17%	16%	20%	14%	16%
4. Photocopying, items	135	34	16	50	235
5. Photocopying, per person per	[illegible]	[illegible]	[illegible]	[illegible]	1.0

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4. Photocopying, items	135	34	16	50	235
5. Photocopying, per person per month	1.4	1.0	0.3	5.5	1.0
6. Books ordered, items	137	49	30	16	232
7. Books ordered, per person per month	1.4	1.5	0.6	0.2	1.0
8. ILL requests, items	6	0	1	41	48
9. ILL requests, per person per month	0.1	0.0	0.0	0.6	0.2

This could be looked at as an index of collaboration.

The low percentage of items returned by the Business School was due to the first year of a new Masters Degree programme. If the period covered had been a full year the percentage returned would have been far higher as most of the teaching staff do their research and revision during the summer.

In addition to the requests generated by the cards, the information officer arranged other I.L.L. and photocopying for users of the service and checked whether books were in the library catalogue. During slack periods back-searches of the literature were carried out, but in spite of many requests there was only time to do four of these. During the interviewing for the final evaluation, five people said that they felt the non-routine aspects of the service were the most valuable, but by their nature these aspects do not lend themselves to listing. Some would take a few minutes, others several hours.

6. Final Evaluation

Of the 30 people who had received the service from September 1968 to June 1969, 27 were interviewed in July 1969. One of those not interviewed was too busy with administration to be able to make much use of the service during the period but had not asked to be left out as he was hoping to use the back-log of items sent in the following vacation. Apart from this there was no known bias in the response.

A questionnaire was filled in by the recipients of the service. An interviewer was present in case of ambiguities and to catch any helpful remarks.

Several of the questions refer to photocopying. The new type of form introduced in September 1969 made "impulse" photocopying attractive to users of the service just at a time when departmental funds were suffering from a squeeze. As a result, departments were reluctant to guarantee financing what looked like an open-ended commitment. We agreed to finance photocopying out of project funds up to £2 per person so that the level of financial commitment could be assessed. In practice users were careful of the demands made on this part of the service and the £2 per head was sufficient to last until March, when some departments agreed to finance the photocopying costs though others felt that individuals should pay; hence the reference to March in question 1. We go into the apparently small point in detail because it is symptomatic of the many small points which can reduce the effectiveness of projects of this sort unless cleared up quickly and painlessly.

In Questions 1, 2 and 3 of the evaluation that follows, the figures give the number of people who felt that the statement applied to them: percentages are of the 27 interviewed.

1. Do any of the following statements apply to you?

    a. Since October 1968, I have obtained more Inter-Library Loans than in the previous academic year. 14(52%)

    b. Since October 1968, ordering books for the University Library has been simplified. 11(41%)

    c. Since October 1968, I have obtained more Xerox copies of articles than in the previous academic year. 17(63%)

    d. I would ask for more Xerox copies of articles if they were not so expensive. 15(56%)

    e. I would ask for more Xerox copies of articles if I did not have to sign forms, handle tickets, etc. 5(19%)

    f. I would ask for more Xerox copies of articles if it were not for the copyright restriction. 6(22%)

    g. Since March I have been paying for the Xeroxing out of my own pocket. 5(19%)

    h. Since March I have been paying for the Xeroxing out of Departmental funds. 14(52%)

    i. Since March I have decided not to request Xerox copies of articles. 2(7%)

    j. I would ask for far fewer Xerox copies of articles if I had to pay for them personally. 9(33%)

2. Are there any extensions to the current awareness service which you would like to see incorporated in the future?

    a. Finding and fetching books from the library. 16(59%)
    b. Returning books to the library. 15(56%)
    c. Compiling bibliographies on specific topics 18(67%)
    d. Anything else? Specified as follows: 11(41%)

improved indexing and abstracting;
a plea for organising collaboration to lead to a common system for indexing information;
a method of spotting those dangerous gaps which arise in collections either due to a faulty ordering policy or book losses;

the notification of arrival in the University Library of those statistical series which are published regularly but arrive irregularly;
abstracts of articles in economic journals;
an elementary form of statistics service, if only photocopying series of data;
assistance with book selection and ordering;
checking whether books recommended to students are in the library;
arranging visits to the National Lending Library;
liaison with library staff to decide which books and journals should be restricted to the library

If you have ticked any of the above, which of the following would you be prepared to give up so that the service could be extended in that direction?

e.	Arranging Xeroxing	4(15%)
f.	Obtaining Inter-Library Loans	8(30%)
g.	Ordering books	11(41%)

Comment

With a fine disregard for elementary economics, everyone wanted something under a, b, c or d, but only 15 people were prepared to give up something under e, f or g.

The answers to questions 1 and 2 show the same order of priority for three aspects of the present service: 1. photocopying, 2. Inter-Library Loans, 3. book ordering. However, this ranking does not follow the same pattern as the number of items requested which were:

1.	Photocopies of articles	245
2.	Books ordered	232
3.	Inter-Library loans	75

3. If the current awareness service stopped, do you think the way you use University Libraries would change?

Yes	21 (78%)
No	6 (22%)

Would any of the following statements apply to you, if the service ceased?

a.	I would spend more time in libraries.	15(55%)
b.	I would spend less time in libraries.	0
c.	I would use periodical indexes more often.	12(44%)
d.	I would find what I wanted to read less quickly.	21(78%)
e.	I would spend more time browsing	13(48%)
f.	I would spend less time browsing.	0
g.	I would consult the library staff more often.	10(37%)

Comment

When the answers to this question are compared with the answers to question 6 of the Pilot Evaluation a more positive attitude towards the service is revealed.

4. What percentage of the items which you have received is relevant to:

   a. your present teaching and/or research work?

   b. teaching and/or research work which you intend to do in the future?

   c. what percentage was irrelevant?

The average for each department and for all recipients is given in the following table.

Comment

The low proportion of irrelevant items (c) suggests both that the approach to research by users of the service is a broad one and that recall as defined by Cleverdon (1967) is low.

No. of persons	10	3	9	5	27
Department	Econ.	Ec.Hist.	Pol.	Bus. Sch.	All
(a)	46	60	31	62	53
(b)	29	26	65	14	25
(c)	25	14	4	24	22
	100	100	100	100	100

5. The next questions refer to those items which you did not know about until you received the cards. Of these:

   a. What percentage have you read if they were articles, or ordered if they were books?

   b. What percentage do you intend to read (if articles) or order (if books)? This refers to those items which are relevant to what you are doing now.

   c. What percentage have you filed away for future reference but have not yet read? This refers to those items which may be relevant to what you expect to do in the future.

   d. What percentage did you disregard as irrelevant?

Dept.	Econ.	Ec.Hist.	Pol.	Bus.Sc.	All
a	29	22	14	14	21
b	26	35	11	19	22
c	30	27	61	39	36
d	15	16	14	28	21
	100	100	100	100	100

Comments

The percentage of items of which recipients of the service already knew are given in detail above in section 5. The average was 16%. This low figure should be borne in mind when considering the answer to the next question. The small number of items involved meant that many respondents had to guess.

6. The next questions refer to those items of which you were already aware when you received the cards. Of these:

   a. What percentage have you read if they were articles, or ordered if they were books?

   b. What percentage do you intend to read (if articles) or order (if books)? This refers to those items which are relevant to what you are doing now.

c. What percentage have you filed away for future reference but have not yet read? This refers to those items which may be relevant to what you expect to do in the future.

d. What percentage did you disregard as irrelevant?

Dept.	Econ.	Ec.Hist.	Pol.	Bus.Sc.	All
a	38	53	37	46	42
b	43	21	20	11	25
c	12	26	40	26	23
d	7	0	3	17	10
	100	100	100	100	100

Comments

This was an unsatisfactory question. If people remembered an article it was probably relevant, hence the low figure for (d). The question was asked in order to find the differences between action taken when the attention of a recipient was first drawn to an article by the current awareness service and when they had already heard of the article. There is a marked difference between the answers to questions 5 and 6, but many answers to question 6 were given with warnings that they were really only guesses.

7. The cost per person of each of the following items is approximately the same. Please put a "1" by the one you think would be of most value to your work and a "2" by the next most useful item. If ranking the others seems easy please rank them also.

   a. One four-day visit per year to a London or Oxford library (2nd class rail and reasonable hotel bill paid).

   b. One six-day visit per year to the National Lending Library (rail and hotel bill paid).

   c. A library liaison officer. This is similar in some ways to the present service but with more emphasis on book selection and no individual current awareness service.

d. The present current awareness service

e. An additional book grant of £..... for your departmental library

f. An additional book grant of £..... for your department at the University library.

Comments

In (e) and (f) the blank was filled in differently for each department, depending on the number of people in the department who received the service. Each person was assessed at £18 worth of books, allowing £7 for processing the books in the library (see costs in Chapter 2) to make a total of £25 per person, being the cost per person of the service. For Economics the blank read £180, for Economic History £72, for Politics £90 and for the Business School £180.

In (c) the duties of the library liaison officer were spelled out further during the interview: book selection for University and departmental libraries, maintenance of the departments' catalogues of books in the University library, liaison with other librarians, photocopies of current contents pages on the notice boards in the departments but not sent to individuals, photocopying and Inter-Library Loan but individuals to fill in their own forms.

The overall ranking by the 27 interviewed was as follows:

1. The present current awareness service (d)
2. A library liaison officer (c)
3. An additional book grant (e) for dept. library
4. An additional book grant at (f) the University Library
5. Four-day visit to London/Oxford (a)
6. Six-day visit to NLL (b)

The ranking was a definite one, and the following table shows the number of "votes" cast for each choice and each rank.

Rank \ Choice	a	b	c	d	e	f
1	3	0	3	15	4	1
2	2	4	8	6	3	4
3	0	2	3	3	6	4
4	2	1	3	2	2	6
5	1	5	2	0	1	3
6	7	2	0	0	2	1

There was a clear preference for the current awareness service, with the most similar alternative ranking second.

8. The OSTI Library Project will be unable to support the current awareness service after 30 June 1969. The following questions are to find out whether the service should be continued and, if so, how it should be financed.

   Do you believe you are getting

   a. more use than average from the service

   b. less use than average

   c. about average use

Comments

Of the 27 interviewed, 9 believed they were getting more than average, 4 less than average, and 9 about average use. Our reason for asking this question was to try to reduce the "free rider" problem when services are financed from a central kitty. We felt it would aid in the answers to question 9 below. However, 5 people could not answer the question. As one respondent put it: "I believe that belief should be based on evidence."

9. The next questions are not hypothetical. Please note that you may well be asked to pay the amount to which you commit yourself. Where voting behaviour is concerned, you would be expected to support any of your proposals by exerting pressure within the university committee system.

Comments

Of the 27 people interviewed, 2 were leaving shortly and so could not commit themselves, and another 2 felt they could not answer the questions in the form that they were put. The number of people answering this question is therefore only 23. One of those who could not answer expressed the view that the service was not worth putting on a permanent basis, though it was a valuable experiment. The views of the other 6 not answering this question are not known, but there may be some bias in favour of continuing the service, if the views of the 23 respondents are taken as typical of the 30 who received the service. Comments on the results will bear this in mind.

a. Assuming that there are no funds available from the university, how much of your own money would you be willing to pay for the service next year? (It is deductible for tax purposes).

7 people said	£0
6 people said	£5
1 person said	£7.5
6 people said	£10
3 people said	£15

The 23 people said £142.5 total, or about £6 per head.

Comments

Many reasons were given for the answers: family commitments, desire to control own funds, preference for an extra subscription to a journal, the right to expect the employer to provide the tools for the job, in the case of those who said £0; a feeling that he who benefits should pay, that output or leisure was increased, that the service was a valuable teaching aid, that it should be kept going somehow, in the case of those who quoted £10 or £15. The answers were more of an adventure in political economy than an aid to librarianship (see, for example, Leibenstein, 1950).

b. Assuming that there are some university funds available, but bearing in mind the many uses to which these funds could be put, how much do you think the university would be justified in spending per recipient on the service next year?

1 person said	£0
3 people said	£5
4 people said	£10
4 people said	£20

3 people said	£30
1 person said	£40
1 person said	£45
4 people said	£50
1 person said	£200

22 people said £710 total or about £32 per head and one person could not answer this part of the question although he was able to answer the other parts.

Comments

There was no significant correlation between the answers to parts (a) and (b) of this question, nor between these answers and the answers to question 4(c), nor between these answers and the numbers of items sent to each user. The most significant correlation was between 9(a), the personal payment which people are prepared to make, and 4(a), the proportion of items relevant to present teaching and/or research work. However, this correlation was negative at -0.8. The more relevant the information, the less people want to pay for it from their own pockets. This may be a statistical fluke from a small sample, or it may be that people do not welcome reminders of the reading they ought to do, but we think it most likely that lecturers who are busiest with research are least busy with administration, or are at an age when family commitments are increasing more rapidly than salaries, a professional age of three to eight years.

There was also a relationship between the answers to question 8 and questions 9(a) and (b): those who felt they were getting more than average use from the service were prepared both to pay more personally and to vote for more university funds but the difference was not great.

c. Do you think it would be reasonable for individuals to pay part of the cost of the service and the university the remainder?

Yes	15
No	8

Comments

We had assumed when formulating this question that people answering "no" wanted the university to pay all the cost of the service. In practice the question was answered on the basis of principle. Thus one person answering "yes" felt that it was "reasonable" for the university to pay part of the cost but that individuals "should" pay 0% of the cost (see next question). On the other hand, one person answered "no" to this question because he felt that all the cost should be borne by the individual.

d. If yes, what proportion of the cost should be borne by individuals?

1 person said	0%
1 person said	10%
1 person said	20%
3 people said	25%
2 people said	33%
6 people said	50%
1 person said	75%

The 15 people averaged 36%

e. Under these circumstances how much of your own money would you be prepared to spend?

1 person said	£0
4 people said	£5
1 person said	£7.5
4 people said	£10
3 people said	£15
1 person said	£20
1 person said	£50

15 people said £182 total or about £12 per head

Comment

Note that (e) is a different question from (a). All these answers include those given by one of the project team who also received the service:
(a) £15, (b) £50, (c) Yes, (d) 20%, (e) £10.

7. CONCLUSION

As an experiment the current awareness service was certainly worthwhile. The PEBUL team learnt about the wide variation of users' needs, the way these needs can be made explicit only over a period of many months, the very marked cycle of teaching in term and research in vacation which some academics follow, compared with the less marked cycle followed by others.

We were presented with a dilemma at the start of the service. Should we try to provide a service of low quality to a large enough number of people to allow some statistically significant conclusions to be drawn from the surveys? Or was it obvious that their conclusions would be to say that the service did not make much impact? We felt the latter was the more likely so we decided to provide an intensive service to a few people. The final evaluation survey was accurate enough to catch a wide consensus, had one been present, which it was not. The main discovery was the very wide range of opinions about the usefulness of the service. In practice 22 of the recipients were prepared to vote sufficient funds to pay for the total labour cost to all the 30 who received the service. Universities are not, of course, so directly democratic that these intentions can be carried out immediately. We must now wait for a year while the committee machinery grinds on to find what decisions emerge.

The quality of the service depended on taking notice of a wealth of small details. Improved design of forms was appreciated. Adapting users' profiles as a result of conversations during the coffee break was effortless compared with the problem involved in arranging interviews and asking academics to describe their work concisely to a non-specialist. Several users found the more informal aspects of the service to be the more useful: liaison with library staff, the occasional guidance for research students, assistance with book ordering and so on.

The final evaluation survey shows that many users would have liked a wider range of services and facilities. If the range were to be widened to include preparation of bibliographies, advice on statistical series and so on, graduate labour would be essential. In any event, a service which is being continuously adapted and improved requires skilled and flexible labour even if the range is not widened to include such matters. It may be the case that only qualified labour can improve the service, but if the range is kept narrow such labour would get bored quickly. Whatever the type of labour, personnel management and administration would have to be carried out by the University library because the users of the service belong to several different departments and friction could result unless control were firmly under one boss who was not in any one department. (Actually this experiment proceeded very amicably, but this was partly due to the information officer, partly because the service had not developed to the stage where it was looked on as a right, and partly because academics are surprisingly benign towards experiments.)

The aims of employing an information officer are well known: saving time, improving the quality of research work, reducing the number of bottlenecks and so on. All our indicators shows that these aims were being realised to some extent, but they do not show to what extent. Only one user offered to put a figure on the saving in time: one hour per week.

Our indicators also show the very wide difference between one user and another in the value they put upon the service. A university offers many facilities but each additional one that it offers must be at the expense of the others. There will be some sympathy for the man who found the current awareness service useless but who desperately needed three copies of an out-of-print book for a graduate seminar. Distributing information is not the same thing as solving problems. However, the university gains in standing from increases in the quality of its members' work and many of its members assume that they will be provided with "adequate" research facilities. These conflicting forces result in a problem of the distribution of resources.

The facilities which are considered "adequate" will vary from department to department, but the variation within departments can be almost as great as the variation between departments. Our conclusion is that a current awareness service is very worthwhile for some people. Those who do not find it worthwhile will find it a nuisance and will say so. The decision whether or not to provide a service to a user should be based on his individual interests and not on the department to which he belongs, but he will not know he wants it until he has tried it.

References

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CHAPTER 8

USE OF THE DATA COLLECTED

The data we have collected by the methods described in the preceding chapters has been used, in the first place, to add to our general knowledge about libraries and their users, and hence to develop our ideas and in designing the structure of our models. In the second place, it has been analysed, sorted, collated and selected to provide numerical values for the parameters of the models we have built or intend to build; it is this second type of use with which we are concerned in this chapter. Thirdly, our data can be used as the raw material for different studies of libraries and their management, and we hope that the lists of data, analyses and programs in Appendix 5, and the suggestions in Chapter 10, will aid such use.

The tables which form the bulk of this chapter have been refined and simplified from the results of the processes of collection, analysis, sorting, etc., mentioned in the previous paragraph, which have represented the major part of the cost of the project. We have not attempted to give here anything like a complete set of results, but have rather tried to select those which are most relevant or informative in the context of the models we have built and developments of them outlined in Chapter 10. In addition to the results in this chapter, we should draw the attention of the reader at this point to Appendix 8, which brings together the results of several surveys relating to normally unrecorded uses of libraries.

In preparing the tables, we have added notes explaining the way in which they can be used, giving simple examples, as well as identifying the sources of the data, quoting sample sizes and commenting on particular features of the results.

The first six tables provide information of use in calibrating the medium-term resource allocation model, particularly when subdivided by classes of user: Tables 1 to 3 are concerned with the length of time spent by users from various faculties or departments in the University Libraries in Durham and Newcastle, while Tables 4 to 6 deal with their activities inside these libraries. The main comment one might make is that the average figures (not far from one hour per visit) conceal wide variations between departments and between users of different status, which will become important in subdivided models and which do not so far appear to depend on other simple variables such as distance (see Table 11).

The remaining tables are more applicable to user-choice models and long-term planning models than to the medium-term resource allocation models. Table 7 gives the subjective rankings of their information sources by academic staff, which is correlated to some extent with more objective measures in Table 8 (University versus Departmental libraries), and Table 9 (visits to other libraries involving travel), and Table 10 (search methods). The objective measures in Table 8 are the relative frequencies of visits, and the probabilities of on-subject borrowing abstracted from Table 14, and it can be seen in both cases that a rough correlation is obtained between the subjective and objective measures. The rankings in Table 7 and the results in Table 10 can be regarded as contributing to the assessment of subjective expected utility required by the user-choice model described in Chapter 4, and Table 9 is some indication of the "pre-conditioning" caused by training and experience, showing as it does that in the survey period no Oxford graduate used Cambridge University Library, and that nobody except LSE graduates used LSE library, in the survey period.

Table 11 is a typical example of a great many diagrams we have prepared in seeking for the effect of distance on library use; it can be seen that there is not much correlation between distance and use, except for very short distances, and this is the only conclusion we have formed on this topic. Similar studies in other universities are required to disentangle this effect, if it exists, from subject effects.

In Table 12 we encapsulate the replies of undergraduates to questions about their academic activities outside the library, and indicate that the figures must be taken with a pinch of salt - the comparison with a more reliable check on library use proving revealing! When suitably corrected, these figures also contribute to the calibration of user-choice models by indicating the expected utilities of non-library activities. The very lack of agreement between subjective and objective figures is, of course, in line with the discussion in Chapter 4.

Tables 13 to 15 give the results of our "overlap" survey in Newcastle University Library, in which borrowing records were analysed to show what proportion of staff and undergraduate borrowing was "on-subject" and "off-subject" as indicated by the necessarily somewhat imperfect indication of the Dewey numbers involved. This is very important information when we seek to build a model which will help in deciding whether or not to split the university library into sub-sections - if it were not for the overlap of subject needs, there would be clear benefits in subdivision, to be balanced only against "internal" costs but without penalties in the form of increased user costs. The form of Table 14 is determined by an actual proposal to subdivide the library, and the conclusions quoted show how it should be done, if at all. The comparison between these results on a unified library and the analogous ones for the divided library in Durham would be most interesting, particularly in the case of off-subject borrowing involving the use of the "wrong" section of the Durham University Library. The data for the comparison is presently stored on punched cards and magnetic tape, and could be analysed with relatively little effort. We hope to do this in due course, as stated in Chapter 10.

TABLE 1. LENGTH OF LIBRARY VISITS

The following table is extracted from the analysis of Instant Diary Surveys at Durham (A1D and A2D) in November 1966, and at Newcastle (K1N) in February 1968. It gives the average time spent for single visits to the library by faculties, of Academic Staff Members, and Undergraduates, at the two Universities.

Type of User / Faculty	Time in minutes per visit			
	Undergrads		Staff & Research	Staff
	Durham	N'castle	Durham	N'castle
Arts	66	67	67	52
Social Science	81	73	62	29
Pure Science	68	88	34	60
Applied Science	-	90	-	39
Medicine	-	87	-	58
Dentistry	-	92	-	56

Thus, Durham Undergraduates reading Social Science spent an average of 81 minutes per visit during the one-week survey in November 1966, while at Newcastle, Undergraduates in Social Sciences spent an average of 73 minutes per visit during the two-day survey in February 1968.

These figures are broken down, in the case of Durham, by subjects, in Table 2.

N.B. Total number of visits on which these figures are based is shown below.

	Undergrads		Staff & Research	Staff
	Durham (1 week)	N'castle (2 days)	Durham 1 week)	N'castle (2 days)
Arts	1371	1360	317	112
Social Science	710	281	175	39
Pure Science	1456	418	566	141
Applied Science	-	318	-	80
Medicine	-	79	-	210
Dentistry	-	34	-	38

TABLE 2. TIME SPENT IN LIBRARIES IN DURHAM

This table provides a breakdown by department of the time spent by undergraduates, on the one hand, and by Staff and Research students on the other hand, in libraries in Durham. This information has been extracted from the analysis of Instant Diary Surveys (A1D, A2D, A3D) at Durham, carried out for one week in November 1966, and provides a partial breakdown of the Durham figures in Table 1.

1. ARTS	UNDERGRADUATES		STAFF & RESEARCH	
	Total No. of visits	Av. Time spent (mins)	Total No. of visits	Av. Time spent (mins)
Archaeology	-	-	16	48
Classics	49	56	19	19
English	233	61	55	80
French	118	51	17	134
German	54	48	(6)	(31)
History	282	60	46	59
Music	59	35	(10)	(12)
Theology	83	40	39	61
Arts General	419	59	61	73
2. SOCIAL SCIENCES				
Economics	131	103	32	108
Education	-	-	71	53
Law	57	77	20	30
Politics	-	-	38	61
Psychology	97	77	(7)	(58)
Social Theory/ S.S.	115	89	(5)	(47)
Econ/Law }	96	66	-	-
Pol/Econ } Jnt	75	78	-	-
Pol/Law } Hon-	39	93	-	-
Pol/Soc } ours	52	62	-	-
3. SCIENCE				
Applied Physics	39	52	25	31
Botany	109	59	71	35
Chemistry	128	46	130	37
Geography	511	76	67	53
Geology	113	54	62	41
Mathematics	110	88	44	23
Physics	69	63	33	30
Zoology	140	71	62	25
Science General	114	60	60	23

Dashes indicate non-applicability, and insignificant figures have been excluded or placed in brackets in the case of some staff.

8.6

TABLE 3. VISITS BY UNDERGRADUATES TO NEWCASTLE UNIVERSITY LIBRARY

This table shows the number of visits made by undergraduates of Newcastle University by faculties, per day, to the University Library. The information has been extracted from the analysis of the two-day Instant Diary Survey K1N carried out at Newcastle in February 1968.

	No. of visits by undergrads per day (N)	Total no. of undergrads in Univ. 67/68 (T)	No. of visits per undergrad per day (N/T)
Arts 1	640	1140	0.56
Arts 2	41	379	0.11
Social Sciences	141	271	0.52
Pure Sciences	209	904	0.23
Applied Science	150	794	0.20
Agriculture	15	228	0.07
Medicine & Dentistry	57	689	0.08
Law	62	124	0.50
Education	6	26	0.23
TOTAL	1330	4555	0.29

Notes: Arts 1 comprises Classics, English, Modern Languages, History, Music, Philosophy, Theology.
Arts 2 comprises Architecture, Fine Art, Town & Country Planning.
Social Science comprises Economics, Social Studies, Politics.

The table shows, for example, that in Pure Science, 209 visits (some undergraduates made more than one visit) were made per day, out of a total of 904 undergraduates reading Pure Science subjects. This gives a figure of 0.23 visits per undergraduate, which could be used as an "expectation" in a model of Newcastle University Library.

Comments

UNIVERSITY LIBRARY

This table shows the number of visits made by undergraduates of Newcastle University by faculties, per day, to the University Library. The information has been extracted from the analysis of the two-day Instant Diary Survey K1N carried out at Newcastle in February 1968.

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TOTAL	1330	4555	0.29

Notes: Arts 1 comprises Classics, English, Modern Languages, History, Music, Philosophy, Theology.
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The table shows, for example, that in Pure Science, 209 visits (some undergraduates made more than one visit) were made per day, out of a total of 904 undergraduates reading Pure Science subjects. This gives a figure of 0.23 visits per undergraduate, which could be used as an "expectation" in a model of Newcastle University Library.

Comments

The total number of visits per undergraduate per day (0.29) compares with the one visit per week made by Durham undergraduates in November 1966. The difference can be explained by several reasons, such as:

(a) the difference between the universities - Newcastle is largely non-residential and many students come in daily from outlying districts; the university campus is very concentrated, and students are therefore more likely to go to the library during free periods. Durham is mainly a residential university, with colleges reasonably close at hand, so students can get back to their rooms for meals and free periods;

(b) note that the two surveys were taken on different dates.

TABLE 4.

PROFILES OF USE WITHIN THE LIBRARY: PERCENTAGE OF USERS CARRYING OUT CERTAIN ACTIVITIES

In both tables, the percentage figures are percentages of the numbers of users in that category (top row)

4(a) DURHAM UNIVERSITY Nov 1966 - one week 4857 users

Status Activity	Undergrads res. in college	Undergrads not res.	Postgrad courses	Res. students	Ac. Staff	Other
No. of users	2550	1060	151	513	469	114
	%	%	%	%	%	%
Seeking specific items of library stock	52	38	51	41	59	26
Seeking information on a specific topic	25	21	21	16	22	17
Browsing or keeping up to date	11	10	12	18	21	13
Borrowing books	23	19	22	25	26	20
Returning books	18	13	13	14	19	17
Using the catalogue	23	15	27	18	26	22
Working without using library stock	22	38	23	19	3	33
Other uses	10	10	9	25	17	27

4(b) NEWCASTLE UNIVERSITY Feb 1968 - 2 days 3338 users

	Undergrads				
No. of users	2653	69	140	301	175
	%	%	%	%	%
Consulting books	42	23	27	31	37
Consulting library staff	3	4	11	8	4
Borrowing books	13	25	26	25	13
Returning books	8	10	18	16	10
Using the catalogue	6	3	16	15	7
Working without using library stock	69	46	16	5	27
Copying service	3	7	23	15	16
Other uses	6	9	6	4	6

Table 4 (continued)

These two tables show the percentage of users, by status, who performed the various activities shown in the first column. Many users carried out more than one activity in each visit, which explains why the total percentages add up to more than 100%. The information has been extracted, in the case of Table 4(a) from the Analysis of Instant Diary Surveys A1D, A2D, A3D, taken at Durham in November 1966; in the case of Table 4(b), from the Analysis of Instant Diary Survey K1N, at Newcastle, Feb 68.

Comments

The two tables are to a certain extent comparable. The activity "Browsing" in Table 4(a) does not appear in Table 4(b). Conversely the activity "Copying Service" in Table 4(b) is absent from Table 4(a). Also there is no separation of Undergraduates in terms of place of residence in Table 4(b). Finally, "Seeking information on a specific topic" is not comparable with "Consulting Library Staff".

Comparing the other items, however, does lead one to certain conclusions:-

(a) The behaviour of postgraduate course students at Durham is closer to that of undergraduates than to that of research students. This is not so marked in the Newcastle figures, particularly as regards consulting books and borrowing books.

(b) Undergraduates not resident in college used libraries more as a work place (from Table 4(a)) - difference is statistically significant p = 0.001.

(c) A much greater percentage (69%) of undergraduates in Newcastle used the library as a work place than at Durham (22% and 38%). This is most likely due to the survey at Newcastle having been taken nearer to examination time than at Durham, also because of the geography of Newcastle University, already referred to in comments on Table 3.

(d) A point to note in both tabulations is the large proportion of "Other" users who come to the library to use their own materials only (33% and 27% respectively). These users are mainly External readers who are not members of the University. These figures compare with the "one-third" quoted by Radford for such use by "outsiders" of the Fisher Library, University of Sydney (Australian Library Journal, v. 16, 1967, p.215.)

TABLE 5. CORRELATION BETWEEN TASKS PERFORMED ON LIBRARY VISITS

The figures in the matrix give the value of the correlation coefficient, r, between the various activities listed, e.g. between Consulting Catalogue, and Consulting Books, r = .2

ACTIVITY	B	R	CB	CP	CLS	CC	W	X	OU	LV	S
Borrowing Books	1										
Returning Books	0	1									
Consulting Books	.2	.5	1								
Consulting Periodicals	.1	.2	.2	1							
Consulting Library Staff	0	.1	0	0	1						
Consulting Catalogue	.3	.2	.2	.1	.5	1					
Place to Work	-.1	.1	.1	0	.1	.1					
Xerox Service	-.2	-.1	.1	0	-.1	0	.1	1			
Other Uses	.1	0	-.1	-.1	.1	0	0	-.1	1		
Length of Visit	.2	.1	.3	.3	.1	.2	.4	.4	.1	1	
Size of Sample	0	0	0	.4	0	.2	.2	.2	-.1	.3	1
	B	R	CB	CP	CLS	CC	W	X	OU	LV	S

This matrix table shows the simple correlations between tasks performed by library users when they visit the library. The information has been extracted from the Analysis of Instant Diary Survey K1N, at Newcastle, Feb 68.

Comments

The significance of the value of correlation coefficient r is as follows: r cannot exceed +1, or be less than -1 in value. A value of +1 signifies a perfect functional

The figures in the matrix give the value of the correlation coefficient, r, between the various activities listed, e.g. between Consulting Catalogue, and Consulting Books, r = .2

ACTIVITY	B	R	CB	CP	CLS	CC	W	X	OU	LV	S
Borrowing Books	1										
Returning Books	0	1									
Consulting Books	.2	.5	1								
Consulting Periodicals	.1	.2	.2	1							
Consulting Library Staff	0	.1	0	0	1						
Consulting Catalogue	.3	.2	.2	.1	.5	1					
Place to Work	-.1	.1	.1	0	.1	.1					
Xerox Service	-.2	-.1	.1	0	-.1	0	.1	1			
Other Uses	.1	0	-.1	-.1	.1	0	0	-.1	1		
Length of Visit	.2	.1	.3	.3	.1	.2	.4	.4	.1	1	
Size of Sample	0	0	0	.4	0	.2	.2	.2	-.1	.3	1
	B	R	CB	CP	CLS	CC	W	X	OU	LV	S

This matrix table shows the simple correlations between tasks performed by library users when they visit the library. The information has been extracted from the Analysis of Instant Diary Survey K1N, at Newcastle, Feb 68.

Comments

The significance of the value of correlation coefficient r is as follows: r cannot exceed +1, or be less than -1 in value. A value of +1 signifies a perfect functional relationship between two variables, an increase of one being associated with an increase of the other. A value of -1 again signifies a perfect relationship, but this time an increase of one variable is associated with a decrease of the other. When r = 0 there is no correlation between the two variables.

In this table, then, there is, for example, no correlation between the activities of borrowing books and returning them. There is a fair degree of positive correlation between "Consulting the Catalogue" and "Consulting Library Staff" (r = 0.5). Again, the only activity at all correlated with the Xerox service is Length of visit (r = 0.4)!

8.10

TABLE 6.

PERFORMANCE TIMES OF TASKS IN LIBRARIES

This table shows the time, in minutes, taken by:
(a) All users at Newcastle University in 1968, and
(b) Academic Staff at Edinburgh University in 1967,
to carry out certain activities in the University Library. The Newcastle figures have been extracted from the analysis of the Instant Diary Survey K1N, taken in February 1968.

ACTIVITY	TIME TAKEN IN MINUTES	
	All Users: Newcastle 1968	Academic Staff: Edinburgh 1967
Borrowing Books	24	21
Returning Books	9	-
Consulting Books	67 }	38
Consulting Periodicals	70 }	
Consulting Library Staff	12	16
Using Catalogue	15	-
Working without Library Stock	99	10
Using copying service	23	6
Other uses	15	13
Average length of visit	81	42

Notes:

1. Blanks in the Edinburgh column indicate that the information in question was not obtained
2. Figures for consulting books and periodicals should be compared with the average length of visit
3. Working without library stock: the Newcastle figure is influenced by the preponderance of undergraduates. Very few staff members carry out this activity
4. Copying service: at Newcastle it is a "do-it-yourself" service

   at Edinburgh it is a "deposit now, collect later" service

TABLE 7.

INFORMATION SOURCES OF ACADEMIC STAFF

Academic Staff were asked to rank various sources of information in order of their importance. This information has been extracted from the analysis of the Postal Questionnaire Surveys at Durham, D6D, April 1967, and at Newcastle, J6N, Feb 1968.

In the table, D=Durham, N=Newcastle.

SOURCES	ARTS		SOCIAL SCIENCE		SCIENCE	
	D	N	D	N	D	N
Personal collection of books	1	1	1	1	2	1
University Library	2	2	2	2	1	2
Other libraries involving travel	3	3	6	6=	6	7
Other libraries through I.L.L.	4	4=	7	5	5	4
Fieldwork, lab work, etc.	6	6	5	6=	4	5
Conference Seminars	5	4=	3	4	3	3
Press, T.V., Radio	7	7	4	3	7	6
Other	8	8	8	8	8	8
No. of respondents	65	69	32	26	113	89

The ratings are, of course, averages taken from all questionnaires returned. It is interesting to note that only Scientists at Durham rate the University Library above their Personal Collection as a source of supply. Also, it is interesting to see how closely the Arts staff at the two Universities agree on their order of priority of sources of supply.

TABLE 8.

USE OF UNIVERSITY & DEPARTMENTAL LIBRARIES AT NEWCASTLE

The information contained in these tables, and in the graph, has been drawn mainly from the analysis of Postal Questionnaire Surveys carried out at Newcastle in February 1968; for academic staff, Question 4 and 5 of survey J6N; for undergraduates, Question 7 of Survey G9N.

Notes

Academic Staff

1. Column 2 shows the ratio of the frequency of use of the university library (fu) and that of the relevant departmental libraries (fd), obtained by analysis of Question 4. Column 3 shows the subjective evaluations of members of staff of their order of priority of the University and Departmental Libraries on sources of supply of material (Question 5). This is shown as inverse ratios of Su (University) and Sd (Department), as the highest ranking gives the lowest number. Column 4 shows the number of staff respondents in each case.

2. Replies from members of twenty departments were analysed. Only those departments with five or more respondents were included in the analysis.

3. Frequency of visits to the university library were correlated against frequency of visits to the departmental library. For the group of nine Arts/Social Science Departments, a coefficient $r = -0.94$ was obtained, indicating that the libraries acted as substitutes. This was significant at the 0.1% level (7 degrees of freedom). For eleven Science/Applied Science Departments, the coefficient $r = 0.41$. This was not significantly different from zero even at the 10% level (9 degrees of freedom), indicating that there is little connection between visits made by staff to the two classes of library.

4. A graph is shown below (fig. 1) of fu/fd plotted against Sd/Su. From this it appears that the relative frequency of visits varies approximately as the comparative value of the libraries as sources of supply of material.

Undergraduates

5. Column 5 shows the same information (i.e. fu/fd) for undergraduates as column 2 shows for staff, and was obtained from Question 6 of the undergraduate questionnaire. Column 6 shows the number of under-

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Undergraduates

5. Column 5 shows the same information (i.e. fu/fd) for undergraduates as column 2 shows for staff, and was obtained from Question 6 of the undergraduate questionnaire. Column 6 shows the number of undergraduate respondents in each case.

6. The response rate to the undergraduate questionnaire, which was distributed to a 20% sample of those in residence at the time of the survey, was 62% (586 forms returned out of 947 sent out). From those returned a sample of about 1 in 3 was selected and the figures given are from these.

TABLE 8(a)

Subject	Academic Staff			Undergrads	
	fu/fd	Sd/Su	No. of replies	fu/fd	No. of replies (see also Note 6)
Arts	1.41	2.44	45	0.82	151
Pure Science	0.71	1.22	71	0.43	48
Social Science	0.69	1.30	26	0.98	37
Applied Science	0.58	1.56	45	-	-
Biological Science	0.57	1.28	18	1.64	35
Agriculture	0.45	0.97	25	-	-
Psychology	0.39	0.70	5	-	-
Medicine	0.38	1.08	123	-	-
Fine Arts	0.16	0.49	27	(included with "Arts" above)	
Law	-	-	-	0.98	17
All students	-	-	-	0.98	465
1st year	-	-	-	0.97	155
2nd year	-	-	-	1.66	153
3rd year	-	-	-	0.83	137

Table 8(b)

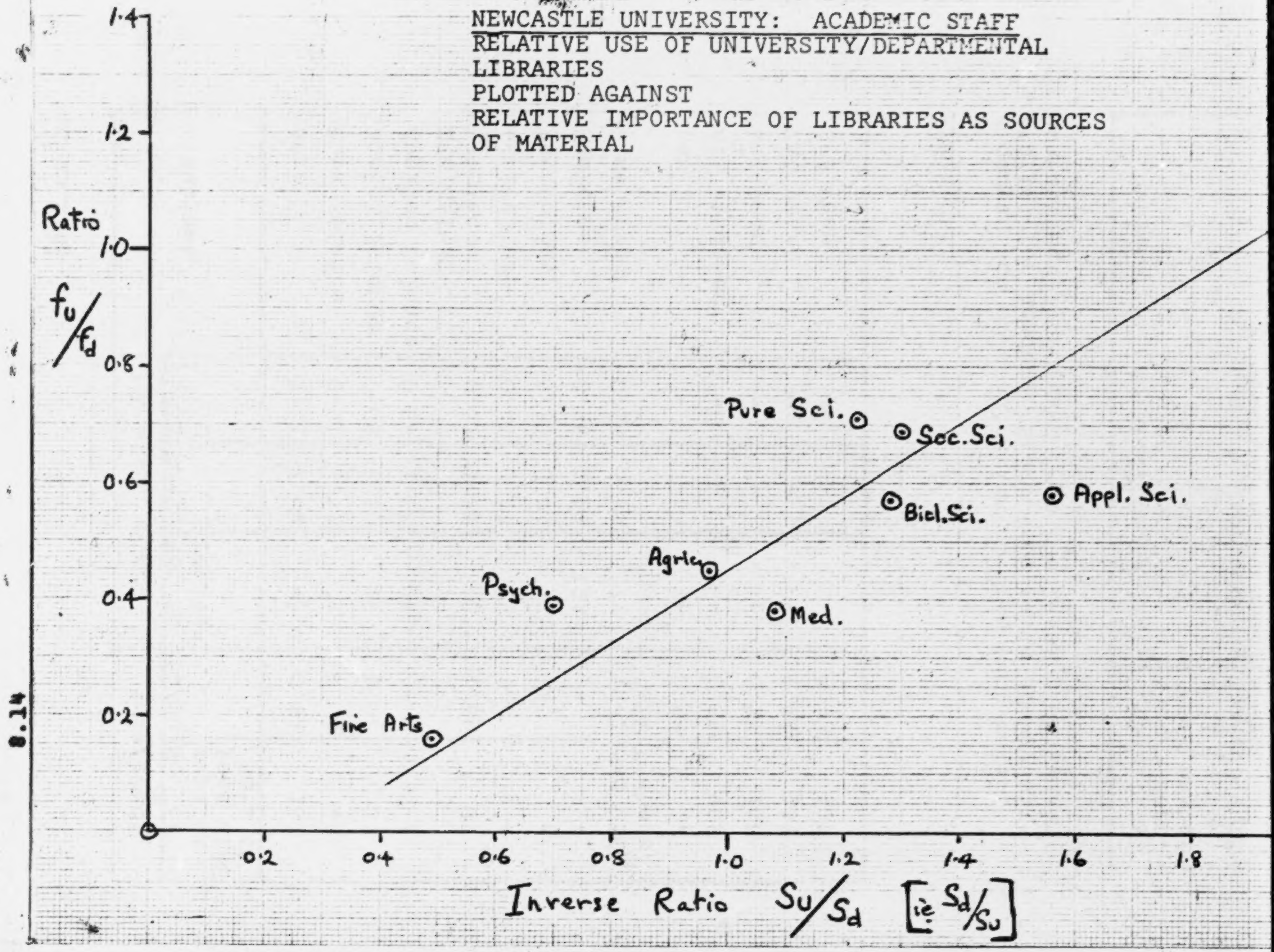
A comparison of a selection of frequency ratios (fu/fd) for Academic Staff (see table above) with "on-subject" borrowing from the leading diagonals of Tables 14(b) and 14(c) yields the following table:

Subject	Ac.Staff fu/fd	Probability of "on-subject" book being borrowed by Dept. Staff P^{c}_{ii}	Probability that a Dept. Staff member will borrow "on-subject" book P^{cd}_{ij}
	Table 8(a)	Table 14(b)	Table 14(c)
Arts, Fine Arts and Soc.Sci.	0.80	0.80	0.95
Pure Science	0.71	0.64	0.63
Applied Science	0.58	0.68	0.40
Agriculture	0.45	0.72	0.26
Biology and Medicine	0.41	0.76	0.66
Psychology	0.39	0.74	0.53

8.14

FIGURE 1

NEWCASTLE UNIVERSITY: ACADEMIC STAFF
RELATIVE USE OF UNIVERSITY/DEPARTMENTAL LIBRARIES
PLOTTED AGAINST
RELATIVE IMPORTANCE OF LIBRARIES AS SOURCES OF MATERIAL



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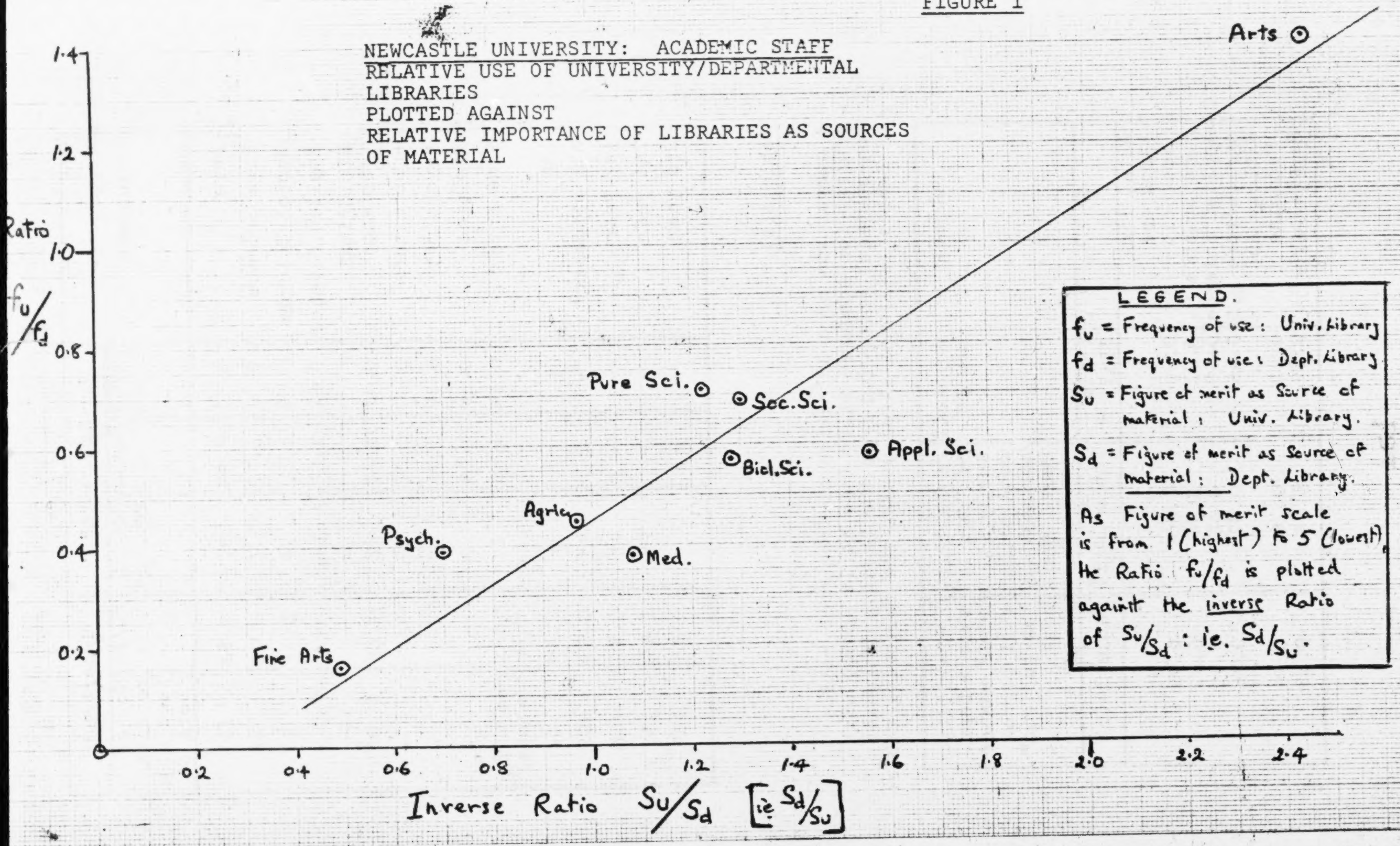

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TABLE 9.

VISITS TO OTHER LIBRARIES: STAFF

During one week of vacation in April, 1967, 16% of the graduate staff of the Arts and Social Science faculties used libraries outside Durham (29 people out of a total staff of 187. Geography is excluded from both figures). Several visited more than one library, so that the total number of libraries visited was 40.

One factor deciding which library should be visited is the university from which the member of staff graduates, as the following table shows.

Graduate of		Libraries visited					Totals
		Cambridge	Oxford	L.S.E.	B.M.	London (not L.S.E., B.M.)	
Cambridge	12	4	3		6	3	16
Oxford	10		3		5	5	13
L.S.E.	3			3	1	1	5
Other London	2				2	2	4
Other universities	2		1			1	2
Totals	29	4	7	3	14	12	40

TABLE 10.

SEARCH METHODS

From the analysis of the Postal Questionnaire Survey G9N, which was taken in January 1968 at Newcastle, some useful information was obtained from Questions 9 and 11, and Question 19. The survey was directed at a 20% stratified sample of undergraduates.

10a. Searching for known books

(Survey G9N Questions 9 and 11)

53%	of the students tried the University Library first.
44%	of the students tried their Departmental Library first.
3%	of the students tried neither Library, but went to outside libraries
100%	

Of those who preferred the University Library, most first and second year students tried the Departmental Library as an alternative; most third year students tried the Central City Library.

10b. Searching for books on a given subject

(Survey G9N Question 19)

Men(%)	Women(%)	
66	72	went straight to the shelves.
25	28	used the subject catalogue.
2	2	consulted the library staff.
2	6	used other means.

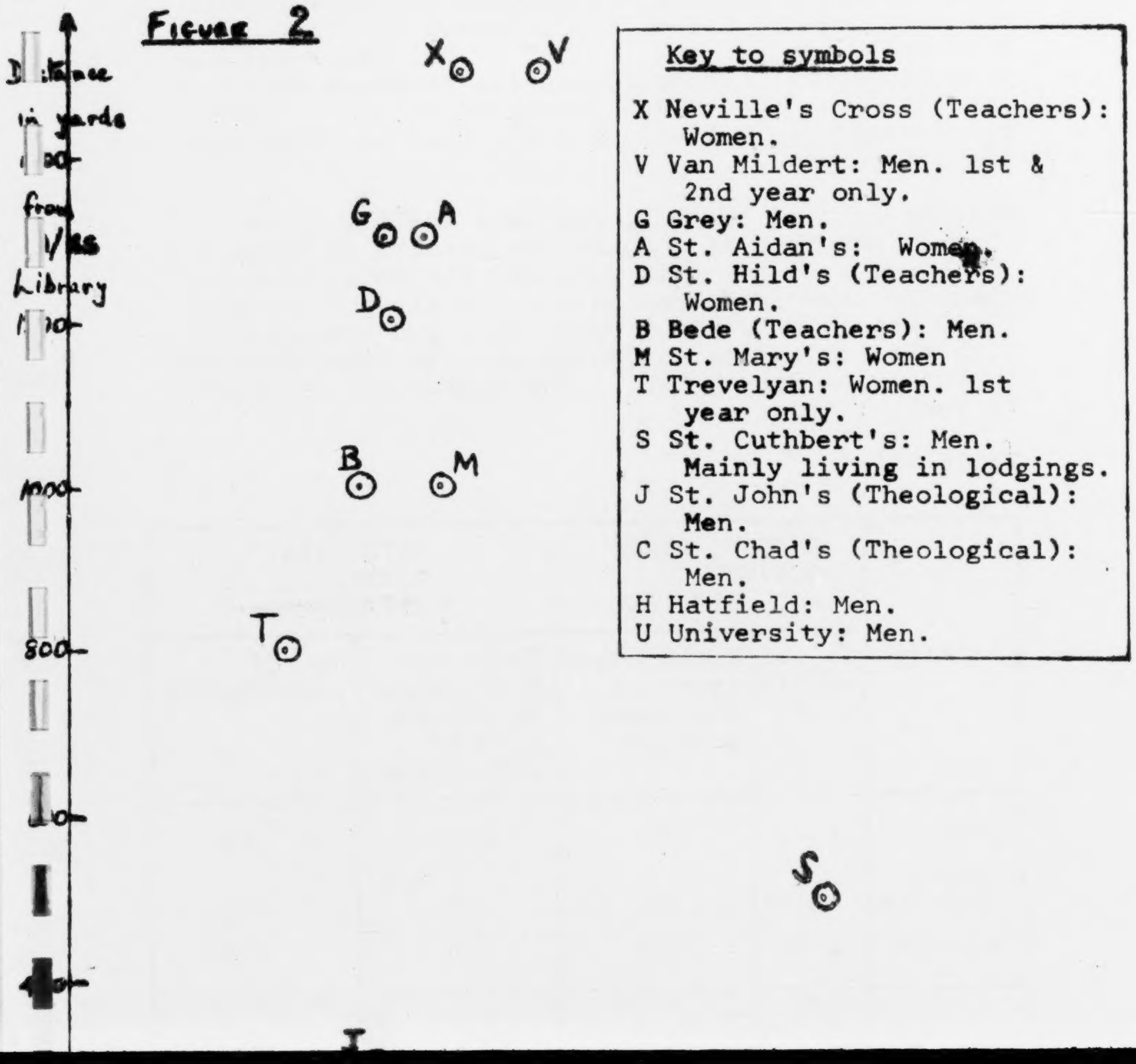
The totals do not add up to 100, as some respondents gave more than one answer. 6% of the men look for books only when they know the author or title.

TABLE 11.

EFFECT OF DISTANCE ON LIBRARY VISITS BY UNDERGRADUATES

From the analysis of the Instant Diary Survey A1D, the total number of visits made to the Arts/Social Science Library at Durham by students of each College was computed. The distances of each College from the Library was measured, and from University Statistics the number of Arts/Social Science students in each College was obtained. Hence the following graph (Figure 2) is plotted.

Figure 2



Key to symbols

X Neville's Cross (Teachers): Women.
V Van Mildert: Men. 1st & 2nd year only.
G Grey: Men.
A St. Aidan's: Women.
D St. Hild's (Teachers): Women.
B Bede (Teachers): Men.
M St. Mary's: Women
T Trevelyan: Women. 1st year only.
S St. Cuthbert's: Men. Mainly living in lodgings.
J St. John's (Theological): Men.
C St. Chad's (Theological): Men.
H Hatfield: Men.
U University: Men.

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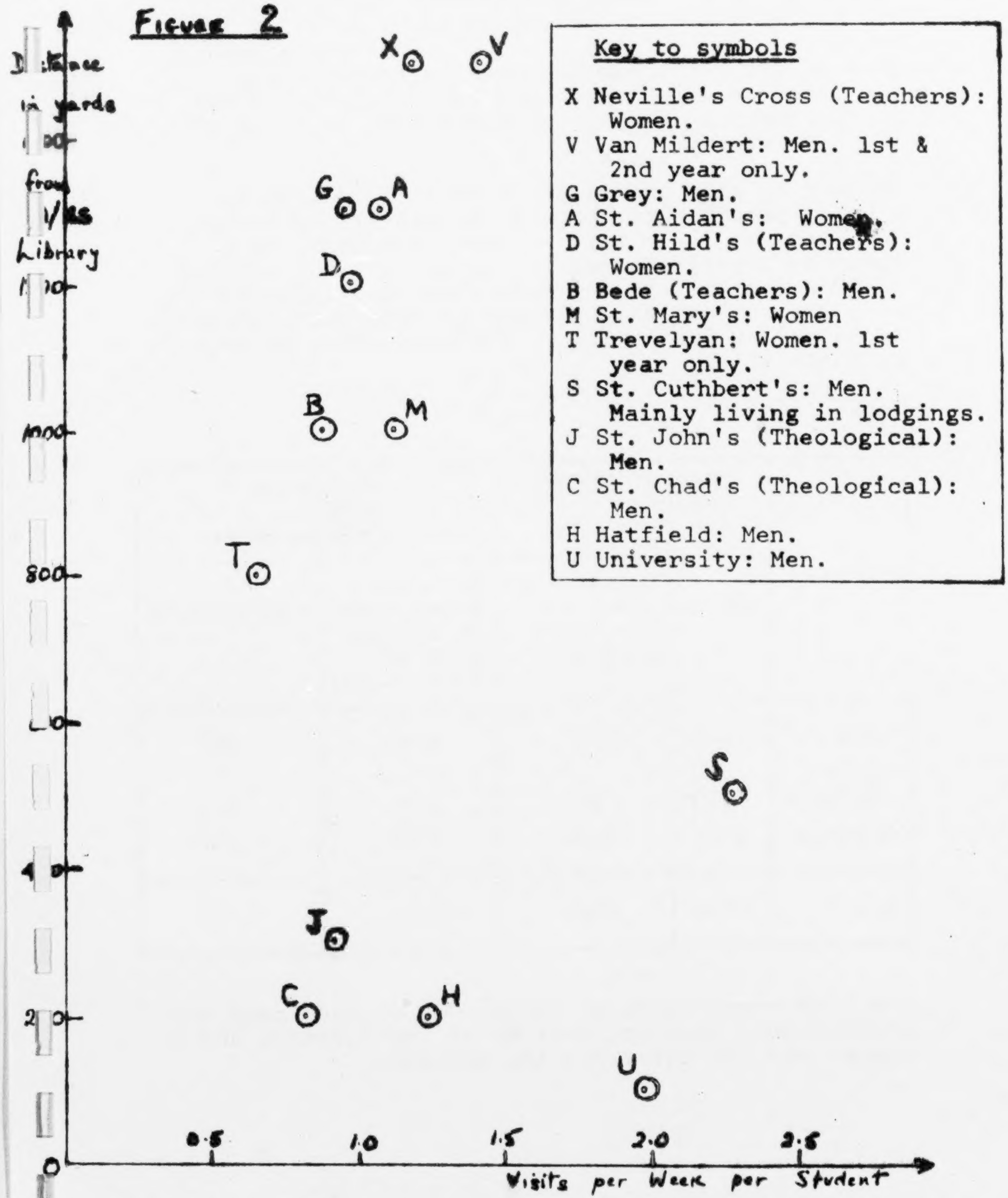

Notes: 1. S. These students live in lodgings, at a rational 500 yards distance (average) from the Library.
2. U. This college is not only the nearest, but its main entrance can only be reached by passing the entrance to the Library.

TABLE 12.

STUDENTS' USE OF LIBRARIES AT DURHAM

During one week in November 1966, Instant Diary Surveys (A1D, A2D, A3D) were taken in the three sections of the University Library at Durham. One of the variables measured was the time spent in the library by each respondent.

The following week an Interview Survey (C9D) was taken of students, who were asked, at Question 2 "In the past seven days, how many hours have you spent on the following activities? (a) ..... (d) Visiting the University Library: Arts/S.S.: Science: Oriental: (e) ..... " This was a population study, not a sample, and the response rate was 76% (i.e. about 1750 undergraduates). There is no reason to suspect relevant bias in those who did not respond.

Bearing in mind the response rate of 76%, it is clearly possible to compare the results of these two surveys. For this purpose, the total time spent by undergraduates in the library for surveys A1-3D was calculated by faculties, and compared with the subjective estimates of this time obtained in Interview Survey C9D. The comparison is shown in Table 12(a):

Table 12(a)

Faculty	INSTANT DIARY SURVEYS A1D, A2D, A3D		INTERVIEW SURVEY C9D	
	No. of visits	Total hours spent in the three sections	Estimated hours spent in library (76% of population)	No. of respondents
Arts	1441	1356	2086	794
Social Science	710	961	1474	253
Science	1458	1664	2528	699
All	3609	3981	6088	1746

The 1746 respondents to Survey C9D include many who visited more than one section of the Library, and a number who did not visit any section.

lectures. We think that the overestimate is an indication of the cost to the student of visiting the library: the time taken to walk there, the inevitable "rounding upward" of estimates, the uncertainty of finding what they want, and so on.

Looking at the whole range of answers to question 2 of the Interview Survey C9D, the average number of hours spent on each activity is shown in Table 12(c).

Activity	Av. hours spent
1. Lectures	11
2. Practical work	7
3. Seminars, tutorials, etc.	4
4. Visiting Libraries	11
5. Acquiring information from other sources	5
6. Other private study	15
Total	53

Notes: Item 4 includes visits to Departmental, College, and outside libraries as well as the University Library: it cannot be compared with Table 12(a) which only covers the University Library.

Item 5 includes Radio, T.V., and other students notes.

Comparison with University Timetables show the first two items to be reasonable:

e.g. Lectures Av. 1st year science ca 9 hrs/week
Mathematics " 11 hrs/week
Social Sciences " 12 hrs/week
English " 13 hrs/week
Practical Science 2 days & more (ca 14 hrs/week)

The time for attending seminars also seems reasonable. From tables 12(a) and 12(b) it seems that the students were overestimating the time spent in the University Library by 60%-80% (60% on the 76% response), and it seems likely that Item 6 (Other private study) has also been overestimated.

The Random Influence of Time Spent at Lectures on Time Spent in the Library

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The Random Influence of Time Spent at Lectures on Time Spent in the Library

There is some reason to think that a few lectures will stimulate students to do a little work in the library, and a few more lectures will encourage a little more work. However, there is only a limited number of hours in the week, so after some point additional lectures will force students to cut down on the amount of private work. The hypothesis is that there exists a certain amount of formal teaching attended by students which will encourage a maximum amount of time to be spent in the libraries. Note that we are not discussing the number of lectures available to students but rather the number of hours which students actually spent attending lectures.

An examination was then carried out of major departments to see the extent to which their students overestimated the time spent in the University Library. The hours spent by Arts & Social Science Undergraduates in the Arts/SS Section were totalled by Departments, and the hours spent by Science Undergraduates in the Science Section were likewise totalled. Other totals were ignored, (e.g. of Arts students visiting the Science Section, and all the figures for visits to the Oriental Section).

In Table 12(b), Column 2 - Mean - is the mean of the Ratios:-

$$\frac{\text{Total Interview Survey Hours}}{\text{Total Instant Diary Survey Hours}} \quad \text{for each major Department}$$

computed as explained in the previous paragraph.

Column 3 - Standard Deviation - is the Standard Deviation of the individual departmental ratios about the mean for each group. These figures are small enough relative to the means to mark a consistent trend.

Column 4 - Coefficient of Variation - is the calculation

$$\frac{\text{Standard Deviation}}{\text{mean}} \times 100$$

and the coefficients of variation normalize the standard deviations to allow a comparison of the figures. Thus the Arts Departments are the most consistent (smallest coefficient of variation), whilst the Science Departments have overestimated the least.

Once again, it should be noted that all these figures are on the low side, based as they are on only a 76% response to the Interview Survey, but even so, Arts students overestimated by 61%, Social Science by 62%, and Science by 58%.

Table 12(b)

Faculty	Mean	Standard Deviation	Coefficient of Variation
Arts	1.614	0.372	23%

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Once again, it should be noted that all these figures are on the low side, based as they are on only a 76% response to the Interview Survey, but even so, Arts students overestimated by 61%, Social Science by 62%, and Science by 58%.

Table 12(b)

Faculty	Mean	Standard Deviation	Coefficient of Variation
Arts	1.614	0.372	23%
Social Science	1.624	0.502	31%
Science	1.582	0.561	35%
All	1.606	0.480	30%

The usual difficulties arise in interpreting these figures. If students think they ought to spend more time in the library, they may exaggerate in their answers. Those who visited the library the previous week were aware of the Instant Diary Survey and the time stamps on the cards. In answer to other questions in the same Interview Survey they did appear to be trying to be honest. Several said "0" to number of hours spent in

The results of the questionnaire survey give the amounts of time which students say they spend on particular activities, and we are assuming that these figures provide a good index to the time they actually did spend. Obviously some students will have forgotten; others will over-emphasise because the time spent seemed longer than it really was; a few may give the answer they think they ought to give (from the number of students who admitted to spending zero hours in lectures we assume that this last group is only small. Generally, respondents were trying to be honest). If the answers were biassed, the results of the analysis will not be radically altered provided the bias is consistent.

In order to test the hypothesis and estimate the parameters, a series of regressions was run. Four equations were fitted to the data.

$$Y=a_0+a_1X+a_2X^2$$

$$Z=b_0+b_1X+b_2X^2$$

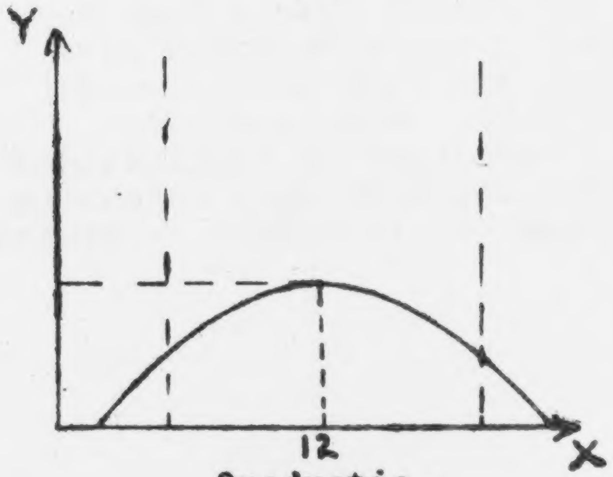
$$Y=c_0+c_1X+c_2X^2+c_3X^3+c_4X^4$$

$$Z=d_0+d_1X+d_2X^2+d_3X^3+d_4X^4$$

where X is time spent in lectures, practicals, seminars and tutorials
Y is time spent in university libraries
Z is time spent in all libraries and bookshops

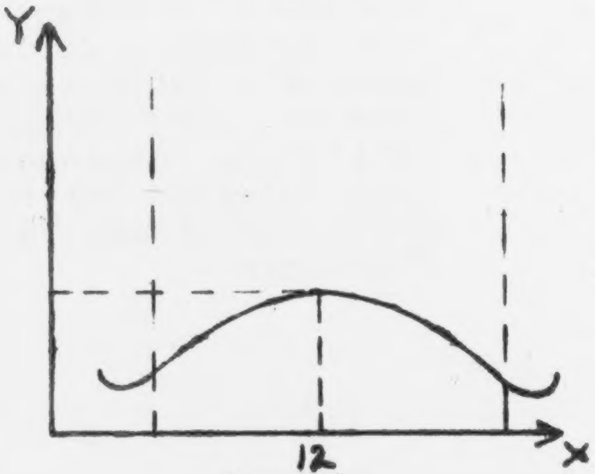
Quadratics and quartics were tried so that the peak value could be found. Figures 1 and 2 illustrate. We expected the peak to be somewhere between $X=10$ and $X=15$.

Fig. 1



Quadratic

Fig. 2



Quartic

In no case were any of the parameters significantly different from zero. Also, the correlations were so low that we can assume X cannot be used to "explain"

Y or Z. However, it is worthwhile setting out the results of the regressions because of the importance of the relation, had we found one. The following table shows the number of respondents for different groups of undergraduates, and the value of R^2 for the quartic regressions on data from each group. (The results of quadratic regressions were similar.) R^2 can be interpreted as the proportion of the dependent variable (Y or Z) that is explained by the independent variable (X).

Table 12(d)

Undergrads	No. interviewed	Dependent Variable	R^2
1st year Science	274	Y	.07
"	"	Z	.08
2nd year Science	236	Y	.16
"	"	Z	.09
3rd year Science	192	Y	.16
"	"	Z	.16
1st year Arts/Soc.Sc.	324	Y	.02
"	"	Z	.01
2nd year Arts/Soc.Sc.	301	Y	.04
"	"	Z	.06
3rd year Arts/Soc.Sc.	259	Y	.03
"	"	Z	.04
All Science	677	Y	.13
"	"	Z	.11
All Arts/Soc.Sc.	886	Y	.02
"	"	Z	.03

We conclude that the influence of formal teaching on time spent in libraries is random. The mind boggles at further interpretation. Is student behaviour random? Are students impossible to inspire? Are lectures far from stimulating?

Perhaps if a longer time period than a week had been chosen, a different conclusion would have emerged. Unfortunately any time series would have involved repeated interviews to avoid stretching respondents' memories or imaginations. Such repeated interviews would be very expensive and would themselves have had an effect on student behaviour.

TABLE 13.

SNAPSHOT SURVEY OF STAFF BORROWINGS: NEWCASTLE UNIVERSITY LIBRARY

A tabulation was made of staff borrowings recorded in mid-March 1968 at Newcastle. Only those Departments whose total borrowings were at least 90 books have been included.

An examination of the table overleaf shows that Arts and Social Science members of staff tended to borrow more than the mean number of books (6.9), whereas Scientists, Applied Scientists, and Staff of Medicine and Agriculture tended to borrow less than the mean.

"On"-Subject borrowing was very high (70% or more) in the departments of Economic Studies, French and Religious Studies; and it was high (50% - 70%) in the departments of Classics, English, Modern History, Chemistry, Electrical Engineering, and Medicine. It was noticeably low in the departments of Social Studies, Botany, Geography, Physics, Chem. Engineering, and Agriculture. In these latter departments the spread of borrowing from other subjects tended to be wide, except in the cases of Botany (which has two other high percentage subjects - Biochemistry and Medicine) and Chem. Engineering (similarly - high percentage subjects Chemistry, Physics and Engineering).

On the other hand, in the departments of English, Modern History, and Chemistry, it can be observed that although "on"-subject borrowing was high, the spread of borrowing from other subject heads was wide.

In the table, Columns 1-3 are self-explanatory. Column 4 - Average - gives the average number of books borrowed per member of staff. Column 5 - "On" Subject Borrowing - shows the percentage of books borrowed by Staff of each Department which were "On" Subject. Column 6 - Other Subjects - shows the percentage of books borrowed from other high rating (over 10%) subjects, including the names of the subjects concerned. Column 7 - Borrowing Spread - shows the number of other subject classes (2% to 10% of total borrowings) from which staff in the Departments have borrowed books.

TABLE 13

Department	Staff Borrow-ing	Books borrowed	Average	"On" subject borrowing %	Other subjects %	Borrowing Spread No.
Econ. Studies	11	132	12.0	72	-	5
Soc. Studies	14	161	11.5	17	Econ. 12	14
Classics	15	255	17.0	68	Arch. 13	5
English	16	386	24.1	55	-	10
French	12	140	11.7	74	-	5
German (G) Scandinavian (S)	11	131	11.9	35 G 24 S	-	9
Mod. History	11	150	13.6	52	Eng. Lit. 12	9
Theology	9	132	14.7	78	-	6
Botany	20	102	5.1	25	Biochem. 18 Med. 14	3
Chemistry	60	294	4.9	52	-	12
Geography	23	148	6.4	11	Geol. 18 Econ. 13	14
Geology	15	95	6.3	43	-	10
Mathematics	32	346	10.8	46	Phys. 12	9
Physics	32	176	5.5	22	Maths. 14 Eng. 12 Geophys. 10	15
Zoology	19	124	6.5	29	Biol. 27 Geol. 18	8
Chem. Eng.	16	97	6.1	20	Chem. 33 Phys. 19 Eng. 12	5
Civil Eng.	14	95	6.8	34 Eng.	Zool. 15 Med. 10	11
Elec. Eng.	17	92	5.4	52 Eng.	-	9
Mech. Eng.	16	109	6.8	50 Eng.	Phys. 17 Maths. 13	8
Medicine	145	689	4.8	56	-	8
Agriculture	49	253	5.2	12	Econ. 20	13
Totals	852	5894	6.9			

TABLE 14

RETROSPECTIVE OVERLAP SURVEY OF STAFF BORROWING NEWCASTLE UNIVERSITY LIBRARY

An examination was made of library records of all books returned by members of the Academic Staff at Newcastle University during the 7 weeks ending 2 December 1967. Two assumptions were made:

1. The books borrowed by staf do not overlap with the books borrowed by undergraduates. Possibly valid in relation to books borrowed within one's own discipline, almost certainly invalid when concerned with 'peripheral' material.

2. Books returned in these 7 weeks are a representative sample of the books borrowed during one academic year (the cycle of borrowing for staff).

Results

Table 14(a) gives a breakdown of the observations taken at Newcastle.

Table 14(b) gives the P^c_{ij} matrix for Newcastle - the probability that a book of a given class will be borrowed by a person from a given Department, when any book of that class is borrowed.

Table 14(c) gives the P^d_{ij} matrix for Newcastle - the probability that a person from a given Department will borrow books from a given class, when he borrows any book.

Table 14(d) gives the P^d_{ij} matrix for Sheffield University 1960-61 for comparison with Table 14(c).

Notes

Psychologists and Agriculturists were singled out as being departments which overlap the proposed library divisions.

Conclusions

The P^d_{ij} matrix is the important one. From this we can make a few suggestions, taking side-glances at P^c_{ij}.

1. Books on agriculture would best be located with those on Biology and Medicine.

2. Books on psychology would best be located with those on Biology and Medicine.

3. In any case, all science books would best be collocated.

TABLE 14(a)

Observations

Dept. Class	P.S.	A.S.	B.M.	P.	Ag.	A.S.S.	Totals
Phys. Science	$\boxed{134}$	25	29	8	1	13	210
Applied Science	11	$\boxed{40}$	2	0	0	6	59
Biology & Med.	10	5	$\boxed{188}$	10	24	11	248
Psychol.	1	1	4	$\boxed{34}$	0	6	46
Agric.	0	0	2	0	$\boxed{13}$	3	18
Arts & Soc. Sci.	56	28	61	12	13	$\boxed{677}$	847
TOTALS	212	99	286	64	51	716	1428

"Boxed figures in all tabulations are the 'on-subject' borrowings as defined by Dewey Class numbers."

Table 14(b)

P^{c}_{ij} The 'probability' that a book of a given class will be borrowed by a person from a given Department, when any book of that class is borrowed.

Dept. Class	P.S.	A.S.	B.M.	P.	Ag.	A.S.S.	Totals
Phys. Science	$\boxed{.64}$	.12	.14	.04	0	.06	1.00
Applied Science	.19	$\boxed{.68}$	.03	0	0	.10	1.00
Biology & Medicine	.04	.02	$\boxed{.76}$	.04	.10	.04	1.00
Psychol.	.02	.02	.09	$\boxed{.74}$	0	.13	1.00
Agric.	0	0	.11	0	$\boxed{.72}$	.17	1.00
Arts & Soc. Sci.	.07	.03	.07	.01	.02	$\boxed{.80}$	1.00

"Boxed figures in all tabulations are the 'on-subject' borrowings as defined by Dewey Class numbers."

TABLE 14(c)

P_{ij}^{d}: The 'probability' that a person from a given department will borrow books from a given class, when he borrows any book.

Newcastle

Class	Dept.	P.S.	A.S.	B.M.	P.	Ag.	A.S.S.
Phys. Science		.63	.25	.10	.12	.02	.02
Applied Science		.05	.41	.01	0	0	.01
Biology & Med.		.05	.05	.66	.16	.47	.01
Psychol.		.01	.01	.01	.53	0	.01
Agric.		0	0	0	0	.26	0
Arts & Soc.Sci.		.26	.28	.21	.19	.25	.95
Total		1.00	1.00	1.00	1.00	1.00	1.00

Based on 1428 loan records.

TABLE 14(d)

Sheffield

Note Departments at Sheffield include Geography and exclude Agriculture.

Class	Dept.	P.S.	A.S.	B.M.	P.	Geog.	A.S.S.
Phys. Science		.89	.38	.06	.01	.29	.01
Applied Science		.02	.56	.01	0	.01	.02
Biology & Med.		.03	.01	.79	.04	.08	.02
Psychol.		0	0	.02	.70	0	.01
Agric.		0	0	0	0	.02	0

P^{d}_{ij} The 'probability' that a person from a given department will borrow books from a given class, when he borrows any book.

Newcastle

Class	Dept.	P.S.	A.S.	B.M.	P.	Ag.	A.S.S.
Phys. Science		.63	.25	.10	.12	.02	.02
Applied Science		.05	.41	.01	0	0	.01
Biology & Med.		.05	.05	.66	.16	.47	.01
Psychol.		.01	.01	.01	.53	0	.01
Agric.		0	0	0	0	.26	0
Arts & Soc.Sci.		.26	.28	.21	.19	.25	.95
Total		1.00	1.00	1.00	1.00	1.00	1.00

Based on 1428 loan records.

TABLE 14(d)

Sheffield

Note Departments at Sheffield include Geography and exclude Agriculture.

Class	Dept.	P.S.	A.S.	B.M.	P.	Geog.	A.S.S.
Phys. Science		.89	.38	.06	.01	.29	.01
Applied Science		.02	.56	.01	0	.01	.02
Biology & Med.		.03	.01	.79	.04	.08	.02
Psychol.		0	0	.02	.70	0	.01
Agric.		0	0	0	0	.02	0
Arts & Soc.Sci.		.06	.05	.12	.25	.60	.94
Total		1.00	1.00	1.00	1.00	1.00	1.00

Based on 12417 loan records

1. The P^{d}_{ij} matrices for Sheffield and Newcastle are given for comparison. The departments have been grouped in broad categories to indicate the degree of inconvenience which could be caused by dividing a single library into faculty-based sections.

2. Mr. W.L. Saunders made available to us the data from Sheffield University survey of borrowing during

1960-61; the $P^{d}ij$ and $P^{c}ij$ matrices for academic staff have been calculated. Although this data may seem rather stale, the range of teaching departments at Sheffield resembles that at Newcastle, and the ready availability of data encouraged us to make the comparison. This data represents a retrospective survey of borrowing for a complete academic year.

TABLE 15.

RETROSPECTIVE OVERLAP SURVEY OF UNDERGRADUATE BORROWING - NEWCASTLE UNIVERSITY LIBRARY

In order to test the hypothesis that

"University undergraduates use their library only as a source of material of direct application to their course of studies",

an examination was carried out of the books returned by undergraduates at Newcastle during the week 27th November - 2nd December 1967. This week was chosen as being one week before the terminal recall data of 12th December, and a large number of books (906) were returned during that week.

The results are tabulated below. Many of the samples are too small to draw any separate inference from, but taken all together, less than 10% of books borrowed (in fact, 83 out of 906) were outside the expected spheres of the borrowers. It is also clear that the majority of borrowers were reading Arts (524 books - 56 outside the expected sphere), leaving 382 books borrowed by all the remainder with only 27 outside the expected spheres.

The results are tabulated in the following way:-

Table	15(a)	ARTS
	15(b)	PURE SCIENCE
	15(c)	APPLIED SCIENCE
	15(d)	SOCIAL SCIENCE
	15(e)	LAW, EDUCATION, AGRICULTURE, MEDICINE

TABLE 15(a) ARTS

Subject	No. of individual borrowers	Borrowers as % of students on course	No. of books borrowed	No. of books outside own sphere	Class Nos. of books outside own sphere
General Arts	57	17%	122	1	614
Classics	6	12%	12	1	593
English Language & Literature English & Philosophy	65	38%	145	9	225 865 330 867 589 913 704 940 942
French. German	20	10%	35	1	398
French & Spanish Modern History	30	39%	72	22	180(2) 282(2) 192 307 260 821 270(8) 872(3) 274(2) (E14)
Music	1	12%	4	-	
Geography, Anthropology, Economics & Geography, Politics & Anthropology	26	20%	48	1	170 (By Anthropology student)
Philosophy, Psychology, Philosophy & Psychology	15	23%	27	4	821(3) 827
Scandinavian Studies	5	14%	11	-	
Spanish & Latin American Studies	8	22%	16	1	759
Theology	4	13%	4	3	821(2) 944
Fine Art	7	6%	13	7	372 813(2) 823 583 821 859
Architecture: Town & Country Planning	13	7%	15	6	159 598 942 510 913(2)
TOTALS	257	18%	524	56	

TABLE 15(b) PURE SCIENCE

	No. of individual borrowers	Borrowers as % of students on course	No. of books borrowed	No. of books outside own sphere	Class Nos. of books outside own sphere
General Science	37	6%	76	-	
Anatomy Bacteriology	5	36%	11	1	860 (by Bacteriology student)
Botany	10	42%	21	-	
Chemistry	2	3%	5	-	
Maths & Computing	2	5%	5	4	418 (4)
Geology	2	12%	3	-	
Physics	3	7%	4	-	
Zoology	14	33%	22	2	532 551
Total Science	75	8%	147	7	

TABLE 15(c) APPLIED SCIENCE

Chemical Eng.	9	7%	10	1	576
Civil Engineering	11	10%	19	-	
Electrical Eng.	7	4%	15	2	720 (2)
Mechancial Eng.	7	4%	13	-	
Metallurgy	4	5%	9	-	
Mining Engineering	1	2%	2	-	
Naval Architecture	9	8%	11	1	946
Public Health Eng.	2	33%	8	1	547
Production Eng.	2	40%	5	2	616 617
Total Applied Science	52	6%	92	7	

TABLE 15(d) SOCIAL SCIENCE

Subject	No. of individual borrowers	Borrowers as % of students on course	No. of books borrowed	No. of books outside own sphere	Class Nos. of books outside own sphere
Economic Studies	19	12%	37	6	370 942(4) 629
Social Studies	6	13%	9	-	
Economics & Accounting	4	17%	6	1	813
Economics & Social Admin. Politics & Econ., Politics & Social Admin. Sociology & Social Admin.	11	18%	17	-	
Total	40	14%	69	7	

TABLE 15(e) LAW, EDUCATION, AGRICULTURE, MEDICINE

Law	3	2%	5	1	830
Education	16	8%	29	See note	Books borrowed cover a wide field. Hard to define areas outside own sphere.
Agriculture	9	4%	13	2	942 947
Medicine, Dental Surgery, Psychological Medicine	18	3%	27	3	330 439 All by 709 Medical students

CHAPTER 9

HISTORICAL REVIEW

1. Introduction

The original application for a one-year pilot project was made on 28 July 1966. The project was then entitled "A cost-benefit study of the value of university libraries".

2. The Pilot Project

a. Plans

The pilot project was intended to establish methods and criteria for a larger O.R. project concerned with the measurement and computer simulation of the operation of university libraries, considered as productive units in the economic sense.

Surveys at Durham were proposed to provide a test of sampling techniques for the larger project, and of methods devised for assessing the value in teaching and research of the library services and information sources surveyed. It was also proposed to investigate costs, marginal productivities and possibilities of intersubstitution of resources used in providing library services.

Finally, a computer simulation of the operations of Durham University Library was to be prepared, a reconnaissance would be made for the main survey in other universities, and close contact would be maintained with related projects elsewhere.

b. Practical Work

At the outset, it was necessary to develop survey methods which would enable the project team to appreciate the size and scope of the problem. The design of suitable questionnaires required a great deal of careful thought to make sure that the questions were correctly framed, and that the forms would be easy to analyse. Briefly, the proposed survey methods comprised:

i. Examination of the present records in the various libraries

ii. Keeping records of number of people using the libraries by means of recording turnstiles, etc.

iii. Questionnaires for completion by library-users iv 100% check over short periods of total library usage. Sample checks to cover the whole year

v Diary records to be kept by a sample of the University population, of information sources

vi Unsolicited selective dissemination of abstracts to discover shortcomings in user demand

vii Interviews of staff and students to discover details of library etc. usage

viii Checks of library records to trace individual book borrowing

ix Survey of costs and internal library operation

A report on the pilot project in June 1967 showed that many, but not all, of these proposed methods were in fact developed and used.

Referring back to the above list:

i Information from issue slips (100% over a period of a year) was punched for analysis by computer

ii Turnstile records of the Science Library were kept of the number of people using it daily over the whole year from October. An electronic counting device was developed in conjunction with the Applied Physics Department, and installed at the entrance to the Arts/Social Science Library, which enabled a fairly accurate (within 5%) record of the number of daily visitors to be maintained from the Spring of 1967

iii) iv) "Instant Diary" Surveys tested quantitatively the different types of use made of the libraries in Durham over a period of one week in November 1966, and a further day in May 1967 for comparison

v The idea of Diary Records was not pursued. It was considered that a sample would not have been unbiassed, as few members of the University were prepared to cooperate in such a demanding activity. It was also considered that the information obtained under item vii (see below) would be sufficient

vi See information marketing project (below) vii During November and December 1966, undergraduates were interviewed by a team of willing recruits, to discuss their use - and non-use! - of the library, and their other sources of information. About the same time, staff and research students were asked to complete a postal questionnaire, with similar objects, but also including teaching commitments. During the Easter vacation 1967, staff were again asked to complete a postal questionnaire, with an additional object of grading their sources of information.

viii See i above

ix A survey of costs was postponed to a later part of the project

Item no. vi was covered by the Information Marketing project, which was started in the Department of Economics on 1 March 1967. This project combined a Current Awareness service - including "Current Contents" and lists of recent accessions to the Arts/Social Science Library - with Selective Dissemination of Information of Journals kept in outside libraries, and so was a more comprehensive service than was originally contemplated. A full report on this part of the project appears at Chapter 7.

A review of all surveys, including those mentioned above, carried out for P.E.B.U.L. appears at Chapter 6, "Data Collection Methods".

c. Methods Selection and Development

In parallel with this Survey activity, considerable thought and discussion was given to the methods which could be used to evaluate the benefits of University Libraries. Two papers give a good idea of the team's thinking at that time.

(i) The first, entitled "Assessing the Benefits of Library Innovation", written by Dr. J. Hawgood in July 1967 proposed a method known as "Subjective evaluation by well-informed users, filtered by the organisation power structure". Two problems were examined - first, the provision of library users sufficiently well-informed about library and information uses, costs and needs; and secondly, the derivation of a single benefit index from a multiplicity of subjective responses.

Two techniques were proposed to try to ensure that the academic staff - considered to be the proper assessors in the university - were sufficiently well informed. These were,

9.4

first, the "information marketing" project (see para 2(b) above), and secondly, making available the most relevant results of extensive surveys, of effort expended by staff and students in using library and information services, and the costs of providing them.

The derivation of a single benefit index was to have been carried out by applying the main features of the decision structure, by which ordinary library spending is determined, to a set of allocations by academics of hypothetical extra library funds - a method known as "Hypothetical Fund Allocation (HYFA)".

The HYFA scheme involved the "pricing", in annual terms, of various possible improvements to the University Library Service. These improvements included (this is not a complete list):

Books:	A	Books & publications for University Library	One £10 unit buys £5 worth
	B	Books & publications for Dept. Library	
	C	Bibliographic Aids	10 units
Buildings & Equipment:	E	Automatic Issue, Union Finding List etc.	3 units
	F	Telex & improved ILL	7 units
	G	Binding Service	35 units
Staff:	J	Reader Service Librarian ($\frac{1}{2}$ day per week)	40 units
	K	Library clerk ($\frac{1}{2}$ day per week)	8 units
	L	Extending opening hours	10 units
Other Services:	N	SDI service to individuals	100 units
	O	Translation Service, Specific to Depts.	1 unit/ 2 articles
	Q	Introduction to authors for preprints	2 units

The annual cost quoted was in units of £10, and Departments were provided with a complete "price-list", and invited to prepare a reasonable priority list of the way in which a hypothetical extra library grant of up to £2000 should be available the most relevant results of extensive surveys, of effort expended by staff and students in using library and information services, and the costs of providing them.

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Staff:	J	Reader Service Librarian (½ day per week)	40 units
	K	Library clerk (½ day per week)	8 units
	L	Extending opening hours	10 units
Other Services:	N	SDI service to individuals	100 units
	O	Translation Service, Specific to Depts.	1 unit/ 2 articles
	Q	Introduction to authors for preprints	2 units

The annual cost quoted was in units of £10, and Departments were provided with a complete "price-list", and invited to prepare a reasonable priority list of the way in which a hypothetical extra library grant of up to £2000 should be allocated. The list might appear in the following way:- A20-C10-B30-A20-F7-G35-A50-Q2 - etc. up to at least 200 units.

A pilot trial was carried out in the spring of 1967, of some of the Science Departments at Durham. A major difficulty was the control of the time-scale, complete with the need not to put too definite a constraint on the budget. Some Departments considered that more books were the main, if not the only, requirement, but others gave some thought-provoking replies, showing a deep appreciation of the problem. It was clear from these answers that considerable modifications would be necessary before HYFA was generally tried out in the University.

(ii) The second paper, entitled "Background notes on PEBUL", written by Mr. R. Morley, filled in some of the economic background to the project. It discussed three types of decisions which are taken about library matters:

I The decision to buy a book
II Decisions concerning the number, size and types of collection
III Decisions concerning further activities of library, especially the "advertising" role

This paper, besides pointing out the requirement for the information marketing (including Current Awareness) project, also paved the way for the preparation of the programming model of a library, which was later developed by means of the technology matrix.

The team's thoughts on Methods Selection and Development were presented and discussed at two OSTI seminars - one at Durham at Easter 1967 and one at Edinburgh on 30 June 1967.

d. Plans

It is difficult to say much about the team's plans, as they were not accepted by OSTI in their original state. It is probably sufficient to say that it was proposed to extend the project to a further four universities in the North. In the event, the extension granted was for one year only at about the same rate of expenditure allowed for the Pilot Project. Under these restricted conditions, the team proposed to continue their work on the lines indicated in para 2(c).

3. The Main Project

a. Practical Work

Under the terms of the one-year extension, the team was only able to extend its survey activities to one University. During the course of the pilot project, a cordial relationship had developed between the team and the Library Staff at Newcastle University, and the Deputy Librarian, Mr. M.B. Line, agreed to be co-opted as one of the project's Principal Investigators. Furthermore, Newcastle University was concerned about the lack of space in the University Library, and what steps should be taken to alleviate it.

In cooperation with Mr. Line, a new series of surveys was planned to take place in January and February 1968. Survey questionnaires were designed to cover both the requirements of the PEBUL project, and that of the University planners. The details of these surveys are shown at Chapter 6.

At the same time, the analysis of the Durham surveys was continued, although progress was slow due to lack of, and changes in, staff. Also, a survey was taken during February and March of the views of members of staff in receipt of the Current Awareness Service at Durham, an analysis of which is given in Chapter 7.

Throughout the year, work continued on the analysis of the surveys held at Durham and Newcastle. This was laborious work, not helped by changes in staff. A fair proportion of the analysis was on a scale more conveniently done manually. On the computer side, a change of the University computer also effectively slowed down the work.

b. Methods Selection and Development

The progress of thinking on methods of evaluating the Benefits of University Libraries is well illustrated by the successive documents prepared for the two OSTI seminars in the first half of 1968.

The first of the seminars took place at the National Lending Library in January 1968. At this point in time, the analysis effort was directed to obtaining information both for the HYFA experiment, and for the programming model of a library.

The second seminar was held at the University of Lancaster in May 1968. A significant change in thinking had taken place during the interval between these seminars. Instead of HYFA, which was essentially a subjective assessment by academic staff with no check on personal bias, a technique known as "Inverse Programming" was defined. This technique was in part implicit in our discussion of the programming model at the first seminar.

The technique was given a first explanation at Lancaster. The line of thought behind the technique was the dependence of a resource-allocation process on the explicit, or implicit, consideration of an objective function, which measures the difference between benefits and costs such that maximisation of the objective function corresponds to choice of the optimum policy. In linear of dynamic programming, the objective function is used explicitly, so that these techniques cannot be used to determine policy if benefits have not been quantified. However, if a policy is known and postulated as optimal, the Linear Programming technique can be inverted to find an objective function consistent with the policy adopted. The values given to the objective function can then be examined, and compared by the policy-maker with his conception of the values which he must have imputed when allocating the resources.

The new method was proposed for use at three levels in the library planning field:

1. Strategic planning of library sub-division and siting

2. Tactical planning of deployment of library funds and staff

3. Day-by-day planning of library use by an individual

An interesting sideline to the change of method was that the surveys carried out for this project produced data which were still required in the new situation. The care taken in the early stages of the project in setting up these surveys therefore produced excellent dividends.

c. Plans

In June 1968 it was decided to apply for 3-year support of the continuation of PEBUL, and for 3-year support of an allied project TULIP (Testing University Libraries by Interpolative Perturbation). The two projects were to be interlinked, but TULIP would have involved active interference in the system studied.

The intention was that PEBUL should use the inverse programming technique to derive benefit scales from simulations of real planning situations in university libraries, both at the strategic and the tactical level. TULIP meanwhile would try to improve communications between the library and the users, in order to bring closer together the benefit scales implicit in decisions made by the library administrators and users. This plan, however, was not approved and instead a nine-month extension, from 1 October 1968 - 30 June 1969, was granted, to enable the Inverse Programming Method to be validated, and for the analysis work to be completed.

4. Main Project - Extension

A further OSTI Seminar was held at Sheffield in August 1968. For this seminar a progress report was prepared, the most important part being a paper entitled "Components of the Inverse Programming Model". This paper discussed a Taxonomy of library resources and activities, and demonstrated the preparation and use of a Technology Matrix, designed to describe the resources and activities of the Arts/Social Science

Library at Durham. In January 1969, a paper entitled "What and How do University Libraries Produce?" formalised and extended this discussion (see Chapter 2). A paper (see Chapter 4) "Method of Library Assessment by Inverse Scheduling" demonstrated and validated the Inverse Programming Method at Level 3 (Day-by-day planning of library use by an individual).

During this period, analysis of surveys was continued, as was the Current Awareness/S.D.I. service to the Social Science Departments, which ended in May 1969. A final user survey of this service was carried out, and is reported on in Chapter 7. The final few weeks were used to prepare and publish this Final Report.

CHAPTER 10

SUGGESTIONS FOR FURTHER WORK

This chapter outlines some direct extensions of our work in the university library field, mostly involving developments of our resource-allocation and user-choice models. Before going on to describe these, it is worth mentioning that the inversion method itself could be applied to the assessment of social or "intangible" benefits in any situation for which a planning model lacking only an optimisation criterion could be built,* and that within the information field the specific models we have developed could be relatively easily adapted to other types of organisation - in fact, we see no obstacles in principle to the development of a routine commercial service for helping librarians and information-service managers with their planning problems.

The rest of the chapter is divided into five sections, of which the first two describe developments of the resource allocation model, the third outlines a possible approach to the effect of distance on library use, the fourth is concerned with developments of user-choice models and the last deals with further analyses that could usefully be made of the data we have collected.

Field trials of resource allocation models

The simple model has been applied so far only to one term's working in Durham University Library. It should next be applied in other university libraries, and with this in mind we have prepared the Prospectus given as Appendix 6. We intend to use the information obtained from librarians who complete the proforma to prepare further computer runs of the model and hence obtain "importance-ratios" (or "swap-rates" in the terminology of Chapter 3) for different universities for comparison with those for Durham.

At the same time, we shall continue to apply the model in Durham in an iterative interaction with the actual allocation process carried through by the Librarian and the appropriate committees (as it happens, one of us has just been appointed to the responsible committee) with the dual objective of aiding planning and refining swap-rates.

SUGGESTIONS FOR FURTHER WORK

This chapter outlines some direct extensions of our work in the university library field, mostly involving developments of our resource-allocation and user-choice models. Before going on to describe these, it is worth mentioning that the inversion method itself could be applied to the assessment of social or "intangible" benefits in any situation for which a planning model lacking only an optimisation criterion could be built,* and that within the information field the specific models we have developed could be relatively easily adapted to other types of organisation - in fact, we see no obstacles in principle to the development of a routine commercial service for helping librarians and information-service managers with their planning problems.

The rest of the chapter is divided into five sections, of which the first two describe developments of the resource allocation model, the third outlines a possible approach to the effect of distance on library use, the fourth is concerned with developments of user-choice models and the last deals with further analyses that could usefully be made of the data we have collected.

Field trials of resource allocation models

The simple model has been applied so far only to one term's working in Durham University Library. It should next be applied in other university libraries, and with this in mind we have prepared the Prospectus given as Appendix 6. We intend to use the information obtained from librarians who complete the proforma to prepare further computer runs of the model and hence obtain "importance-ratios" (or "swap-rates" in the terminology of Chapter 3) for different universities for comparison with those for Durham.

At the same time, we shall continue to apply the model in Durham in an iterative interaction with the actual allocation process carried through by the Librarian and the appropriate committees (as it happens, one of us has just been appointed to the responsible committee) with the dual objective of aiding planning and refining swap-rates.

Refinement of the simple model to take account of differences between types of book, types of user and subjects should be straightforward now the principles of the model construction are established, and we hope to carry out such a refinement for Durham and Newcastle, for which we already have most of the required data and analyses (see Chapter

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* It is now being applied to two other current studies in Durham: an assessment of maternity services in Sunderland and the economic evaluation of computer-based systems.

8), and later to recalibrate the resulting model with data from elsewhere. After a number of trials in different places at this more refined level which corresponds to that of real planning problems, we should be able to establish how much common ground there is between the detailed benefit functions in implicit use in the different libraries studied. At this stage we shall begin to be able to say we have evaluated the relative benefits of the different services offered by university libraries; some discussion of absolute benefits is given in the next section.

Evaluating the benefits from university libraries in money terms

In this section we show how the method of Chapter 3 can be extended to put a money value on the benefits of a university library. Again we make explicit the implicit judgments of decision-takers but here instead of comparing one library activity with another, we compare library activities with activities outside the library. The figures given in this section are to illustrate the type of reasoning rather than to come to any strong conclusion. Although we believe expert opinion would not disagree strongly with the order of magnitude of most of the figures, further work is necessary before they could be considered reliable. It is for this reason that we have included them in this final chapter. They form a group of questions to be answered rather than conclusions to be accepted.

For example, much university research work is carried out on problems which have already been thoroughly investigated. Often this work is done even though the findings of previous research were already published before the duplicating project was started. An estimate of the proportion of current "research" which is avoidable duplication is 6% (some evidence in support of this figure is in Urquhart, 1964)*. It does not seem unreasonable to suppose that if a graduate librarian spent one week working with each research project at its beginning, the amount of avoidable duplication would be reduced from 6% to 3%. Even a small research project will take perhaps 100 man-weeks to accomplish anything. With these assumptions and on the average, 6 weeks of each 100 are spent at present on duplicating the work of others, but perhaps only 3 weeks in every 100 would be spent duplicating if a skilled information searcher were used. Three weeks of a researcher's time has been saved in exchange for one week of a librarian's time. Put differently, if the number of research staff were reduced by one percent and the number of library staff were increased by one percent, there would be an increase in the output of original research of three percent. To the reduction in waste due to duplication must be added some amount for any expected increase in the quality or speed of research work (Dannatt, 1967)*.

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*Urquhart, D.J. "Use of scientific literature by research students" Nature 202:732 (1964)

Of course, at the present stage of research into librarianship, there is insufficient data to support this type of argument, so decisions have to be taken on the basis of judgment. This is even more the case when considering the influence of librarians on the teaching activities of the university. When decisions about increasing the benefits from libraries are not taken, it is often impossible to tell whether this is because decision-takers are afraid to back their hunches or because the present position is satisfactory.

There are a number of other indicators which may be helpful: the amount of money which academic staff spend on their personal collections, on commercial current-awareness and S.D.I. services, on visits to other libraries. Care has to be taken in interpreting such indicators. If a library stimulates interest, the better the library the more money its users will spend on their own collections. But if users have definite requirements, then the better the library the less they will need to spend on their own collections. Surveys may result in finding out how much people think they spend, or how much people think they ought to spend.

If the present allocation of resources within the university is considered to be roughly satisfactory, the total money value of the activities of the library can be found by making two assumptions: that the measures of relative benefit are correct, and that the value of a graduate's output is known. The measures of relative benefit are given in Table 5 of Chapter 3. By using the second row of this table, together with the levels of the activities as given in Table 4, the total output can be valued using one hour of senior librarian's time as the unit of value. The table below shows how the total output of the Durham Arts/Social Science Library during the summer term of 1968 can be valued in this way.

Table 1

expected increase in the quality or speed of research work (Dannatt, 1967)*.

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Table 1

	Value per unit	Quantity	Total value of the activity
I	3.70	1533	5672
OILL	0.74	244	181
LML	0.0027	57700	156
LL	0.037	15000	555
SL	0.017	1000	17
US	1.00	205	205
UJ	0.37	37	14
Total, in graduate-hour equivalents			6801

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* Dannatt, A.J. "Books, Information and Research: Libraries for technological universities" Minerva vol. v, no. 2 (Winter 1967)

About a quarter of the annual output of these activities is produced during the summer term, so the value of this annual output is 27,200 graduate-hour equivalents. There are other activities of the library which we have not considered: providing a place to work without using library materials (130,000 hours a year), providing inter-library loans for other libraries (1000 a year), providing micro-readers and photocopying. However we will take as an approximation to the value of the library's output 27,000 graduate-hour equivalents.

The costing of the Arts/Social Science section of the library involves the problem of allocating overheads amongst the four main libraries: Arts/Social Science, Science, Oriental and Rare Books. The totals for the group of libraries are accurate to the nearest £1000, but the share to Arts/Social Science is approximate:

	Arts/Social Science	All Main Libraries
Salaries	25,000	56,000
Books & Periodicals	24,000	45,000
Binding	4,000	9,000
Miscellaneous	3,000	5,000
	£ 56,000	£115,000

Whether the library is worthwhile depends on our assessment of the worth of an hour of a senior librarian's time. This should be equivalent to the output of an hour of a graduate's time elsewhere in the university. If it were not, a reshuffling of graduate staff within the university would lead to an increase in output.

If a graduate is reckoned to produce about £2 worth of output an hour, then the library breaks even (ignoring the benefit from activities which we have not listed). However, most graduates cost this amount and one hopes they produce more than they cost. In industry, the output of graduates is generally reckoned to be worth at least £5 an hour. This comparatively high figure is due partly to salaries but also to the very large amount of overheads which enables the graduate to do his work: secretarial assistance, administration, buildings and equipment. Wasting one hour of a graduate's time is also wasting the time of supporting staff and equipment. If £5 is acceptable, then the benefits of the university library are more than twice the costs. This very rough calculation is to demonstrate the type of data needed to work out problems of this type. We can say little about the money value of library activities except that rough calculations lead to the conclusion that the library is worth supporting!

The measurement problem is broadly that of finding close substitutes, one of which has a market price so that a value can be imputed to those which have not.

As with all organisations that are divorced from the market, there is little substitution in response to changes in relative market prices. The demands placed on the library by academics are fairly rigid, so the library cannot alter its blend of resources without leading to a change in the quality of its activities, and this change is resisted. (The change in quality need not involve a net reduction in quality.) Since the library is continually struggling to provide services at the level they were at last year, it has great difficulty in introducing new activities. The management problems and the measurement problems are thus closely related.

A model for estimating the effects of distance on library use

The number of visits per annum which a teacher/researcher makes to the main university library seems to depend on the field of study, the size of the main library, the size of the departmental library and the distance between the department and the main library. "Field of study" is difficult to define but some results might be obtained by aggregating all the fields of study within one department. If the number of visits depends on the department to which the teacher/researcher belongs, it is not possible to separate the influence of the field of study from the influence of distance within the same university. One university can provide only one set of observations for estimating the parameters.

Write V_i for the number of visits per time period made by members of department i to the main library,

S_i for an index of the size of stock in the main library which is relevant to department i,

Y_i for the distance in yards of department i from the main library,

and D_i for an index of the size of stock in i's departmental library.

Then if a Zipf type relationship holds:

$$V_i = aS_i^sY_i^yD_i^d$$

when a, s, y, d are parameters. Of the elasticity parameters, s would be positive, y and d negative.

Unfortunately only V_i and Y_i are unambiguous measures. The indexes of stock, S_i and D_i, involve the problem of aggregating relevant and less relevant monographs and serials. Departments of the same name in different universities will cover a wide variety of fields of study. There may also be multicollinearity because a high value for Y_i may lead to a high value for D_i since over the years the members of the department will have been agitating for a strong departmental library to avoid making the long walk.

In order to give these ambiguities a chance to cancel out a large number of observations would be necessary, perhaps 30 universities.

The choice of which departments to study depends on which seem to cover approximately the same fields of study no matter what the university, and which will yield a large number of visits over the time period. Perhaps six departments would be sufficient; Classics, English Literature, Sociology, Zoology, Geology and Pure Mathematics might be appropriate.

One would avoid departments where the scope varies greatly between universities, such as Geography, Engineering, Applied Mathematics and those with "economics" in the title. One would also avoid departments such as Law and Chemistry where the choice of library depends strongly on where the main journal is kept.

The method therefore would be to use the observation from 30 universities to estimate the six equations, one for each university. The hypotheses to be tested are that the elasticity parameters s, y and d do not vary greatly between different fields of study, and that for the same field of study the equations yield good estimates. If the hypotheses stand up to the tests, the equations provide the information needed in addition to our overlap studies for decisions regarding the size of departmental libraries, the possibilities of splitting the main library into two (an Arts/Social Science and a Science section).

If the above hypotheses do not hold the equation should yield much useful information on users' behaviour.

Further work with user-choice models

The work described in Chapter 4 has reached the stage where a simple model of undergraduate self-scheduling has been given some trial computer runs with made-up data; the next stage is to calibrate it with real data for groups of students with roughly similar timetables. The appropriate data has already been collected and analysed (see, for example, Table 12 in Chapter 8), except that we have no data on individual "conditioning" effects and will have to deal with this part of the model by taking trial parameter values and performing a sensitivity analysis. If suitable agreement with the statistical averages of actual behaviour can be obtained, we shall have a set of subjective utility values for the three places for doing "work", without any attempt having been made to differentiate between different subjects or types of work.

We would hope then to refine the model to allow for different types of user and classes of work, for the detailed interaction of schedule and itinerary, and for the insertion of detailed user-cost components, for which the study outlined in the previous section will also provide raw material. At this stage we shall be dealing much more directly with the library user's information needs and his assessments of their relative value to him. Some extra data will be needed to provide answers to questions about the dependence of the pattern of use on the particular type of activity or stage of a project, which we will need to ask in constructing the refined model. When such a model has been constructed, it will provide detailed values both for subjective utilities of different library services used in pursuance of different goals, and of the users' evaluation of the costs which they incur in making use of these services.

Armed with such results, we shall have one important part of a model to aid in long-term planning of library and information facilities for a university (or, by extension, for other types of organisation). The other important part of such a model would have to deal with capital costs and with the parameters of technical change (which affect both equipment costs and the ways in which information needs can be satisfied). The reactions of users to changes in technical possibilities are another example of a conditioning process: the Current Awareness Service described in Chapter 7 was, in effect, a study of the conditioning of a group of users to a technical change, and long-term planning cannot be attempted successfully without estimates of human reactions to change.

Returning to the problem of the measurement of conditioning parameters mentioned in the first paragraph of this section, which is closely related to that just discussed, we intend to try another method for obtaining such parameters: this is to build a computer model with user-choice and resource-allocation features, allowing human intervention through a console or consoles, and run it as a "game" with people playing roles of library users and administrators. The effects of the provision of extra education and information about library possibilities, and extra help to ensure "good" experience on first visits, might be studied this way as well as by actual experiments in providing such extras in real life. The marketing of library services through education and special guidance through "library hosts" (using I.J.C. Foster's term) may well be as important an activity as increasing the library stock as far as investment in the future benefit from the library is concerned; we need to be able to simulate its effect accurately if we are to judge between alternative options of providing new services and making old ones better known.

Further analyses of data already collected

On page 8.3 of Chapter 8, we explained that there is a considerable amount of data in our possession, stored on punched cards and magnetic tape, still to be analysed. In a future project, we would hope to tackle this large amount of data, which we consider would yield information of vital importance in the long term planning of libraries.

From our Newcastle surveys in Spring 1968, we hope to complete the analysis of Survey K4N (8 Departmental Libraries, Instant Diary) for comparison with that of Survey K1N (University Library, using the same questionnaire). At the same time, a lot more thought is required on the Postal Questionnaire Surveys at Newcastle, (G9N, H7N, H8N, J6N), also carried out early in 1968. From all this analysis, we would be able to have a clearer picture of the advantages and disadvantages of a unified University Library, and also to suggest the least disadvantageous method of splitting such a library, if that is ever necessary.

Perhaps the greatest amount of data as yet unanalysed is in connection with the Retrospective Overlap Surveys, carried out both at Durham and Newcastle. At Durham, loan records for a period of one year 1966-67 have been punched ready for analysis, and a program has been written. The delay now is in obtaining the necessary amount of staff effort and computer time to run all the massive quantities of data in our possession.

This analysis, by comparison with a similar analysis of Loan-Records at Newcastle, already carried out, would help the assessment of the amount of inconvenience which would be caused by splitting a unified library into sections.

Note to other workers in the field

Mention of our intentions in this chapter is not intended to pre-empt the possibility of work in these directions by others. There is much too much for us to carry out in the time we expect to have available in the next few years, and we will be delighted to hear from anyone interested in taking up our suggestions, or in doing other work arising out of this report, with a view to discussion and collaboration.

APPENDIX 1

GEOMETRICAL ILLUSTRATIONS OF INVERSION PROCESS

Any quantitative planning technique in which the criterion for choice of policy is the maximisation or minimisation of a given objective function can be subjected to inversion so that it becomes a way of determining the objective function corresponding to a given optimal policy. For some techniques, such as the dynamic simulation technique used in Chapter 4, the inversion process can be unique, but for others, such as the linear programming method used in Chapter 3, a range of objective functions will correspond to the given policy.

To illustrate this, and to show how the range may be reduced by considering a number of analogous cases with slightly different parameters, we consider the two dimensional illustration in Figs. 1 to 4, which represent a benefit-maximising linear programming problem with two activities u and v and with four resource constraints initially shown as the lines Aa, Xx, Yy and Dd in Fig. 1. The other three figures show the effect of changes of the resource levels and the technical coefficients. In each case, we assume that the policy is known before the analysis starts, and is represented by the vertices H, G B and B' of the respective feasibility polygons. For each case, we want to determine the range of benefit functions which would give the chosen policy as the optimum, and we assume the benefit function is the same in all four cases.

A1.2

Fig. 1

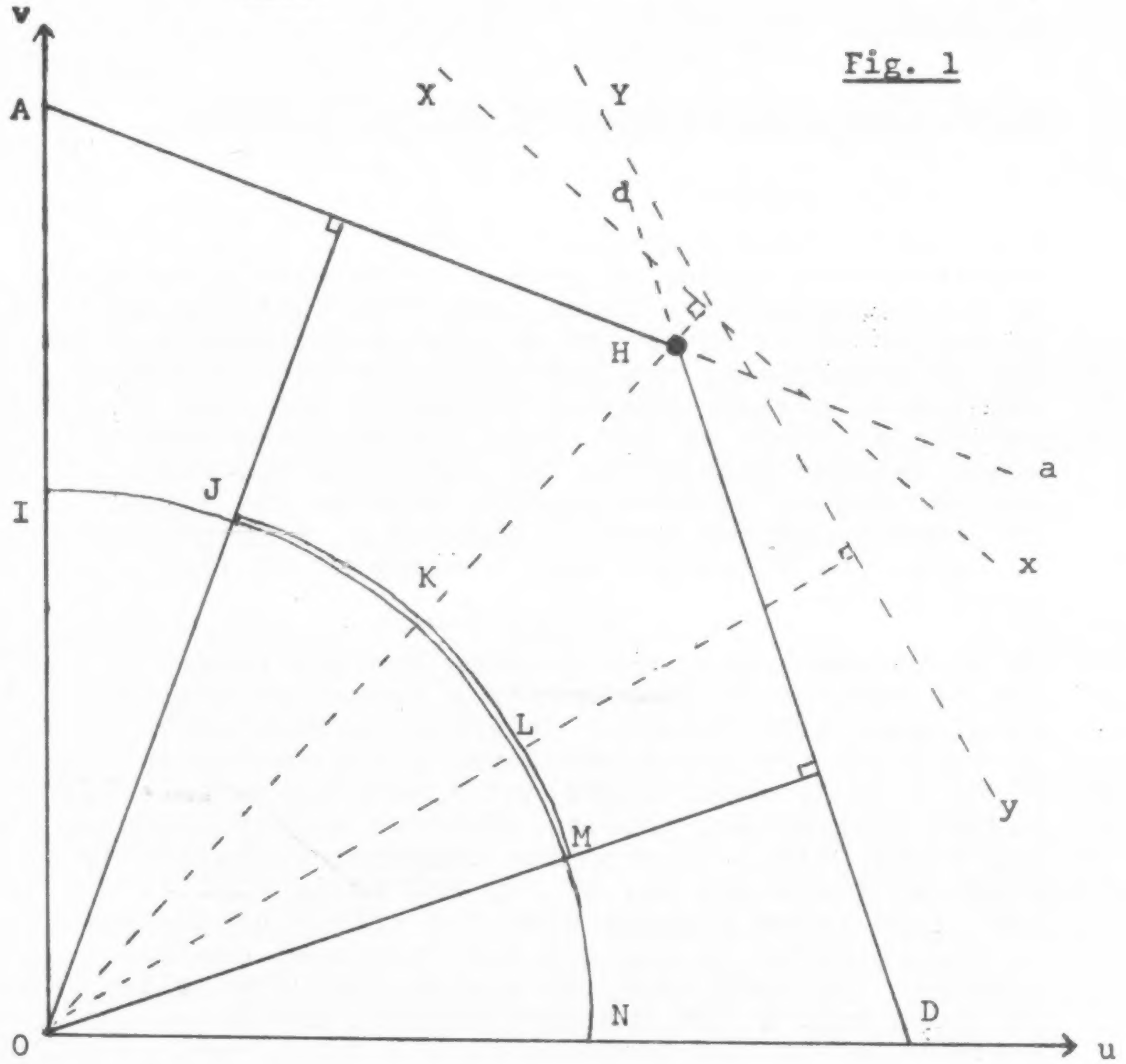
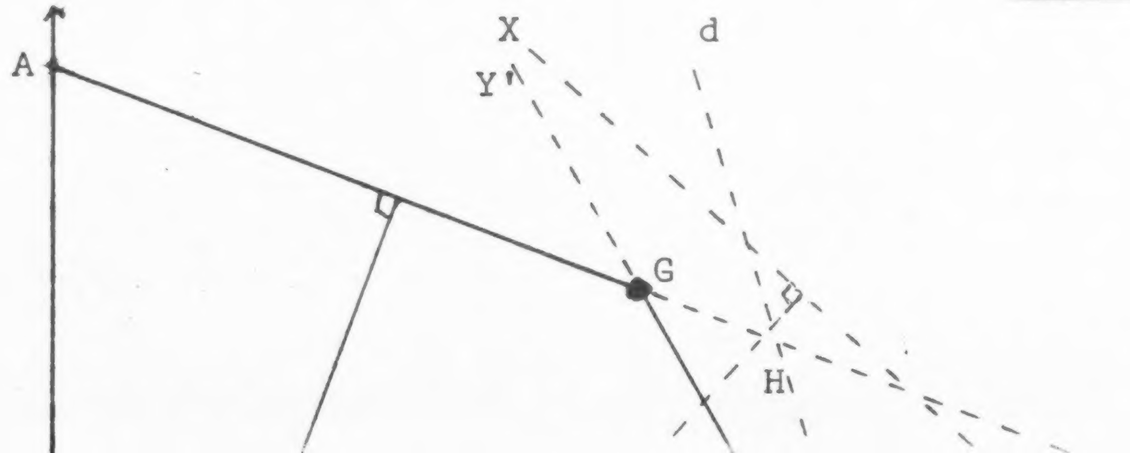

v
A
X
Y
d
H
a
I
J
K
x
L
y
M
O
N
D
u

Fig. 2



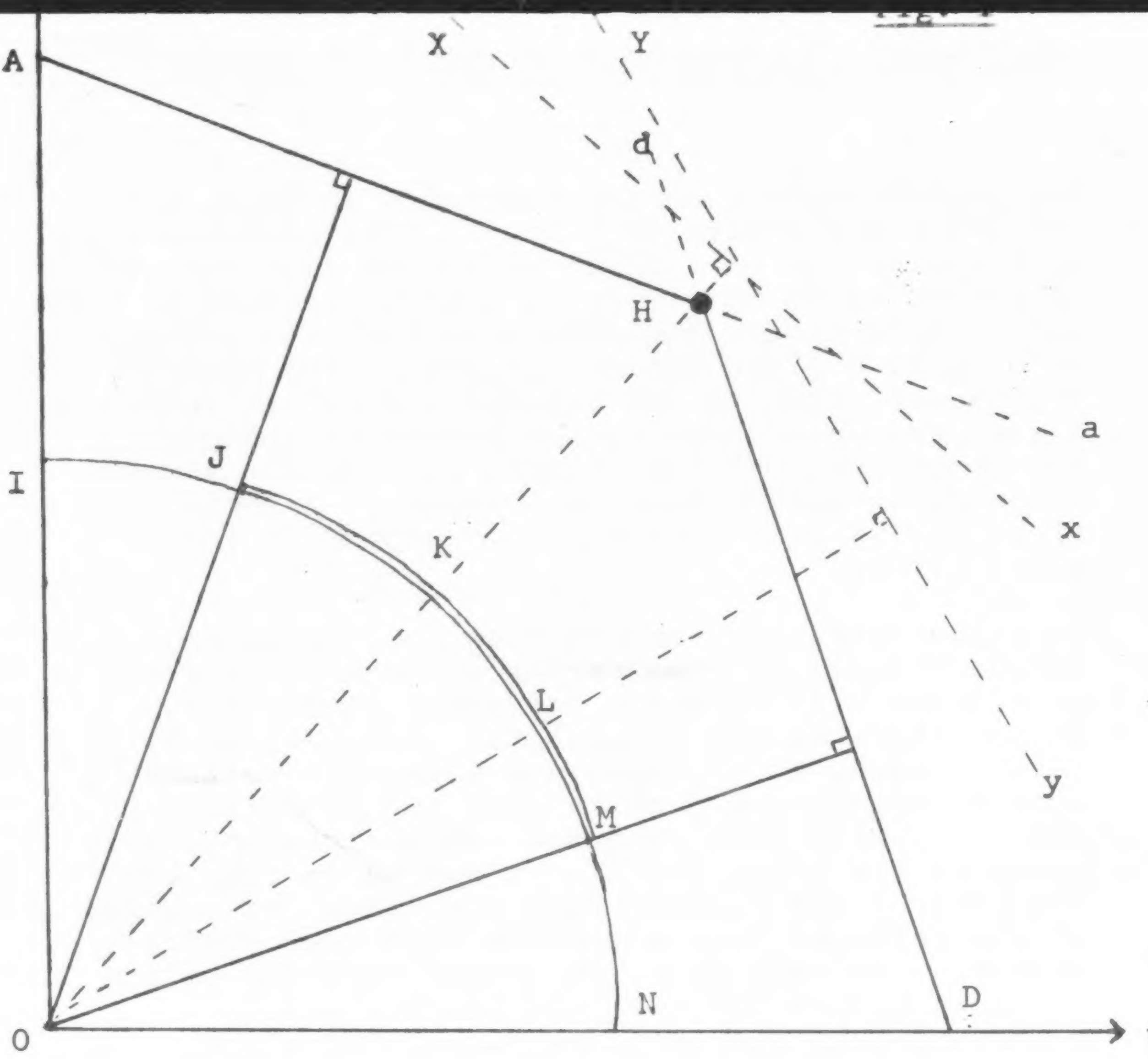

X
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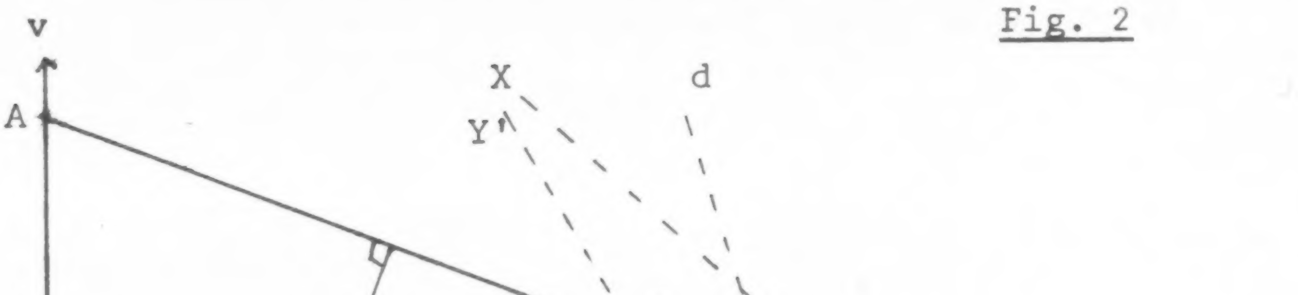
Fig. 2


v
X
d
Y'
A
G
H
a
I
J
K
x
L
F
M
y
y'
N
D
O
u

We can represent a benefit function as a ratio of the value of one unit of v to that of one unit of u, that is, by a direction in the u-v plane, and hence by a point on the quadrant IN, which we will call the "benefit-point". The contours of equal benefit are lines perpendicular to the radius through the benefit point, and the optimal point is the vertex of the feasibility polygon which is furthest from O when measured in a direction parallel to this radius.

In Figure 1, the constraints Xx and Yy are not binding and the feasibility polygon is OAHD. The policy point being given as H, we can say that the benefit-point must be between J and M, the points where perpendiculars from O on to Aa and Dd respectively cut the quadrant. The result of the inversion is not a single point but the whole "benefit-arc" JM. There is a "waste" of resources represented by the distance from H to the lines Xx and Yy.

We can remove part of this waste by reducing the level of one resource from Yy to Y'y', as shown in Fig. 2, in which the policy point is G, a vertex of the new feasibility polygon OAGFD, and the benefit-arc is reduced to JL. To make the diagram clear, this correction has been allowed to overshoot - it should have been done so that the new point G was very close to the old point H. As it is, we have caused a new wastage of the resource Dd, as well as increasing the wastage of Xx. On the other hand, if we had only just removed the wastage in Yy, we would have found it very difficult to know whether G or F was the new policy point, as these would have been very close together; this difficulty crops up in real cases of well-balanced resources when inversion is attempted.

A1.4

Fig. 3

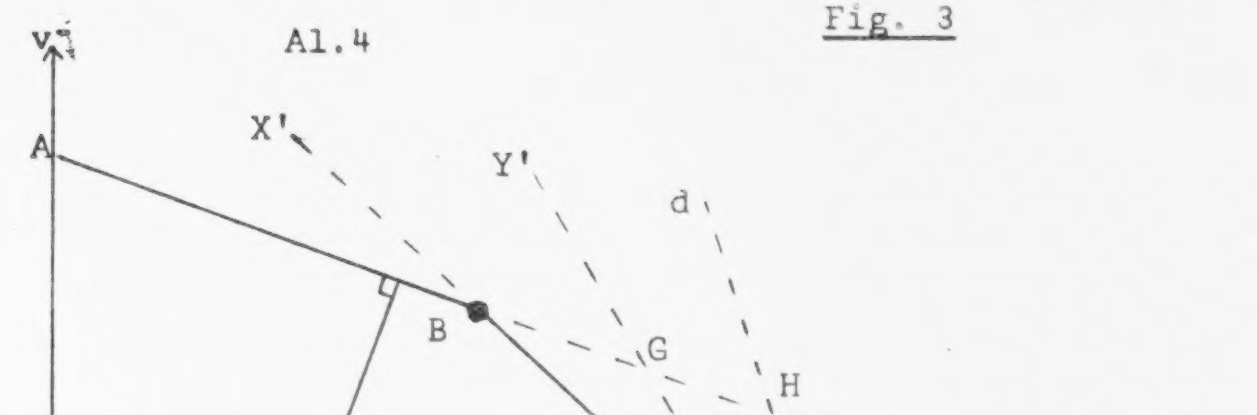

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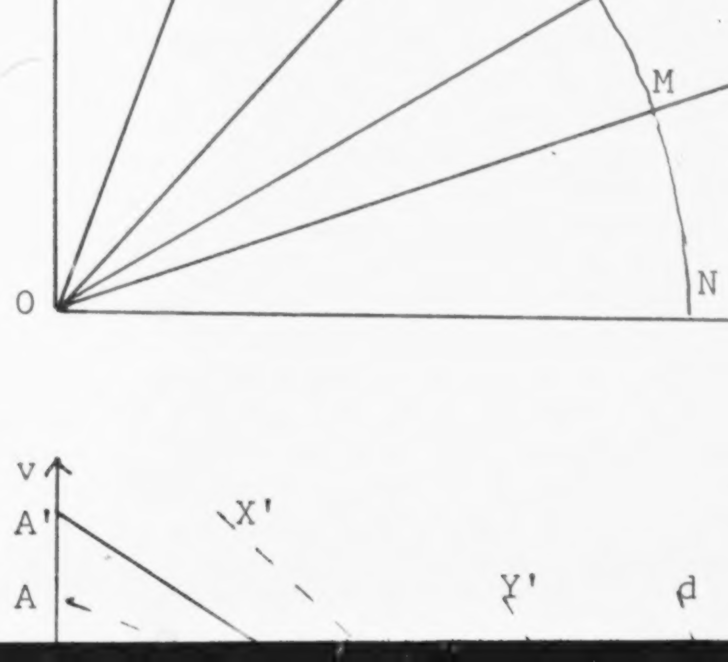
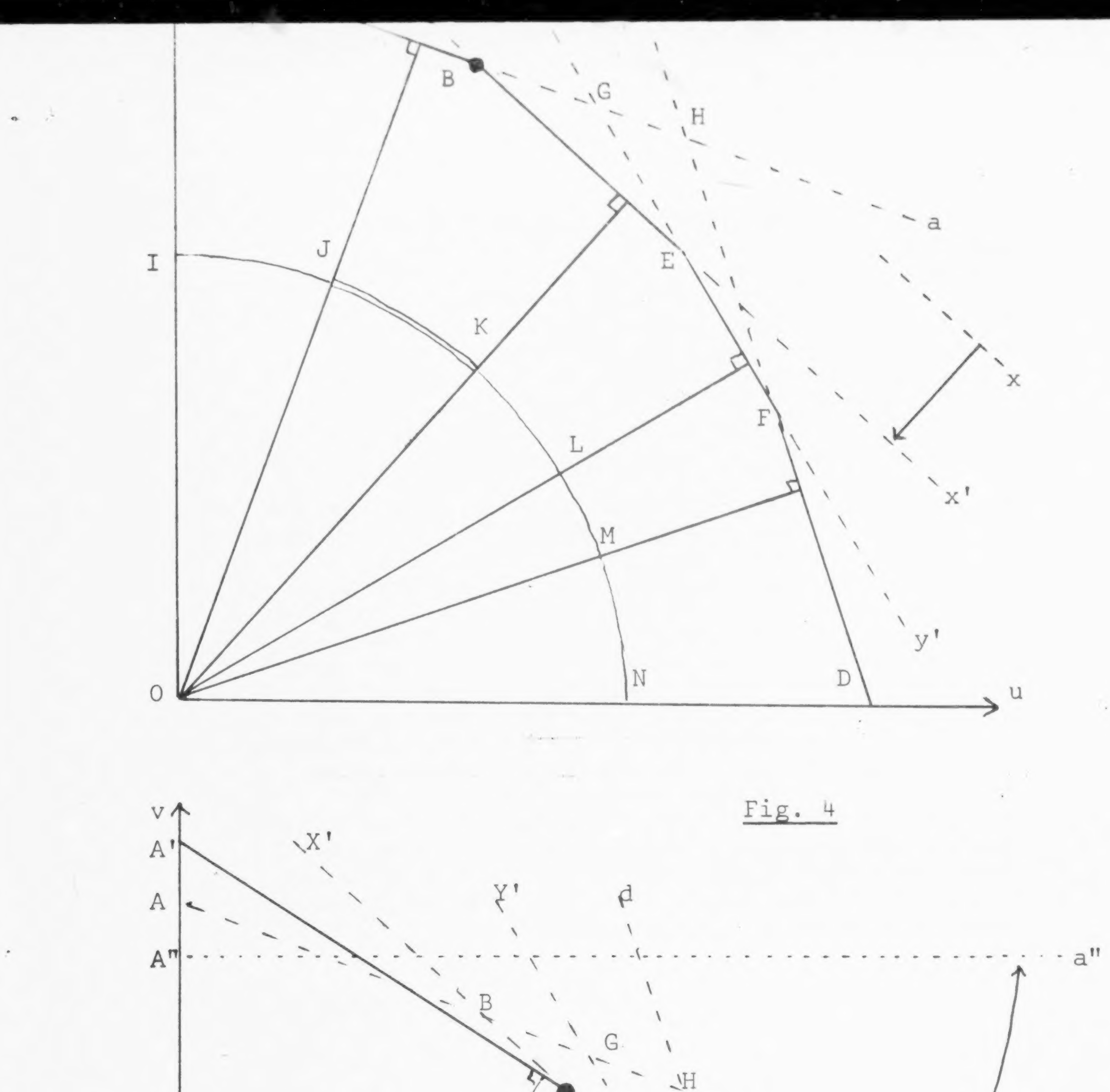
Fig. 4




B
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X'
A
Y'
d
A"
a"
B
G
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B'
a
E
I
P
J'
K
a'
F
L
x'
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Q
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u

Fig. 4

The other resource is corrected by moving from Xx to X'x' in Fig. 3, and the policy point moves to the vertex B of the new polygon OABEFD, giving the new benefit-arc JK. This is the smallest range we can get with the constraints given, apart from the exceptional case of degeneracy when the policy point is on a side of a polygon, the contours of equal benefit being parallel to that side, and hence the benefit-point is where the perpendicular to it cuts the quadrant.

We could narrow the range further by introducing new constraints with slopes between Aa and Xx, or by changing the technical coefficients so as to change one of these crucial slopes. In Fig. 4, we show what happens when the slope of Aa is altered to A'a' by an increase in the efficiency of the use of this resource for the activity v relative to that for activity u. The policy point, as given initially, moves to B', and the benefit-arc is reduced to J'K.

In real life, we may be able to narrow the benefit range by observing changes in policies when resource levels or unit costs (slopes of constraint lines) change, or by observing the converse and more frequent occurrence of changes in resource levels or unit costs made in furtherance of an explicit or implicit policy aim. Further information may be obtainable by posing very precise hypothetical questions to managers about which of two specified alternatives they would choose if a certain resource became scarce: we could, for example, ask whether G or F in Fig. 2 would be the new policy point following a decrease in resource Yy.

One further aid to inversion should be mentioned: it is the exclusion of certain mathematically allowable benefit ranges on economic or common-sense grounds. Consider, for example, what would happen if in going from Fig. 3 to Fig. 4 we turned the constraint Aa to A"a", making it parallel to the u-axis. If the policy point remained the intersection of this constraint with the X'x' constraint, now the point B", the new benefit arc would be IK, because the perpendicular to A"a" would be the v-axis. The point I corresponds to an infinite benefit-ratio between the activities v and u, and it is highly unlikely that this is meaningful in practice. We should be able to exclude the point I itself, and part of the arc near to it, by setting a priori limits on the reasonable benefit ratios, perhaps by excluding the shaded regions outside the arc PQ. Thus the benefit arc with the policy point B" would be PK rather than IK.

Extension of the discussion to more than two activities is direct, though geometrical illustration becomes difficult: we now have to describe in terms of constraint hyperplanes forming hyperpolyhedra, and benefit-surfaces or benefit-cones instead of benefit-arcs. The benefit-cone contains all the sets of direction cosines which can be formed as linear combinations with non-negative coefficients of the direction cosines of the binding constraint hyperplanes meeting at the policy vertex. With more activities, we find more of the constraints are parallel to axes, and common-sense restrictions on allowable benefit ratios become more important. This is easier to illustrate by means of tables than geometrically, and the rest of this Appendix does so for the problem of the inversion of the medium-term model as applied to Durham University Main Library and the policy adopted there in Summer Term 1968.

The data for the example are given in Table 1 of Appendix 6, but we repeat here those figures required for this discussion, though without explaining units or abbreviations. In this model, there are three minimum-demand constraints and seven maximum-resource constraints, of which only four are binding at the policy point, namely those for S, J and P (labour) and L (money). The technical coefficient matrix for these four binding resource constraints is:

Table 1: Technical coefficients

	I	OILL	LML	LL	SL	US	UJ
S	72	4	0	0.6	0	60	0
J	18	72	0.4	5	3	0	60
P	2	12	0.1	0.1	0	0	0
L	56	5	0	0	0	0	0

Note the zeros in the matrix: these all correspond to hyperplanes being parallel to certain axes, with the consequence that infinite benefit-ratios can be included in the benefit-cones unless we take prior action to exclude them. Let us do this by taking as our maximum allowed values of one item of I the following: 1500 hours LML, 500 items SL, 500 items LL, 10 hours US and 100 hours UJ. The direction cosines of the hyperplanes slightly titled to exclude the zeros then become:

Table 2: Limit direction cosines

	I	OILL	LML	LL	SL	US	UJ
S	.77	.04	.001	.01	.002	.64	.01
J	.19	.75	.005	.05	.03	.02	.63
P	.16	.98	.01	.01	.04	.16	.004
L	.99	.09	.001	.002	.002	.01	.001

Note that the ratios of different numbers in the same row are the same as before, except for the exclusion of infinities by removing the zeros;

replaced by the underlined figures. Any linear combination with non-negative coefficients of the four rows can then be used to represent an allowable benefit direction. For example, we might choose the simple sum with coefficients 0.25 (giving the centroid of the four points on the unit hypersphere), which would give us co-ordinates and importance ratios as follows:

Table 3: centroid co-ordinates and importance ratios

	I	OILL	LML	LL	SL	US	UJ
co-ordinates	.53	.47	.004	.018	.019	.21	.005
imp. ratios	1	1.1	122	29	28	2.5	111

Note that the co-ordinates are not direction cosines, the centroid of the four points not itself being on the unit hypersphere. The importance ratios have the meanings used in Appendix 6, namely that 1 item I is equivalent to 1.1 items OILL or 122 hours LML or 29 items LL or 28 items SL or 2.5 hours US or 111 hours UJ.

Alternatively, we could choose any of the four limiting sets of direction cosines themselves, giving four limiting sets of importance ratios:

Table 4: limiting importance ratios

	I	OILL	LML	LL	SL	US	UJ
S	1	18	1500	120	500	1.2	100
J	1	0.25	45	3.6	6	10	0.3
P	1	0.17	20	20	500	10	100
L	1	11	1500	500	500	10	100

There are an infinite number of other allowable sets of importance ratios given by directions within the benefit cone defined by the limit direction cosines. In Appendix 6 we choose the nearest allowable set of ratios to the marginal-cost ratios (using arguments set out in Chapter 3), giving a result (A6) very similar to that (A1) we would have obtained by adding the four sets of limit direction cosines with coefficients 0.7, 0.2, 0.15 and 1.5:

Table 5: comparison of importance ratios A6 and A1

	I	OILL	LML	LL	SL	US	UJ
A6	1	4.6	1300	90	200	3.3	9.1
A1	1	4.5	450	97	130	4.2	16

The correspondence could be made exact by varying the coefficients slightly.

In the calculation we describe in Appendix 6 we did not use the method of considering variations of resources or of unit costs which is illustrated earlier in this Appendix; this will be done to narrow benefit ranges in future calculations.

Appendix 2

The Adequacy of Library Stock

In Chapter 3 a tool of thought was presented which contributes towards a method of obtaining the maximum benefit from existing library resources. An alternative approach, which is more popular in the current literature, concerns measures of adequacy of library stock and how to reach given levels of adequacy at minimum cost. For example, a policy objective could be that 90% of all requests are to be met from existing stock. Various methods of cost saving can be utilised to reach this objective. (One such method is discussed in Appendix 3.)

A library "adequate for users' needs" would be a realistic aim if the library absorbed a negligible part of university funds, or if the library were considered to be of such importance that it overrode all alternative claims on these funds. Neither of these two conditions apply, so the library has to compete for funds with other parts of the university. Although the library is seen to use up funds to an easily measurable extent, its contribution to university activities is far more difficult to quantify.

In most universities in the United Kingdom the size of available funds depends mainly on the number of students. A greater amount is received for students of the applied sciences but this extra is to cover the cost of capital equipment other than books. More is received for graduate students than for undergraduates, but here the extra is to cover the additional teaching loads.

If library adequacy depended upon student numbers to the same extent as does university funds, a study of adequacy would be of immediate importance both for long and short term planning. More students would need more library facilities, but more students bring in more funds which enable more library facilities to be provided. However, a review of the literature shows that adequacy does not depend primarily on student numbers.

Many writers refer to the bookstock as though it is some biological entity with a "natural" growth rate.

> "Unless a college or university library is willing *not* to maintain its place in the steady flow of cultural development, it seems to be inevitable that it must double its library size every fifteen or twenty years." Fremont Rider.

Pitternick (1963) criticises Fremont Rider: academic quality is not correlated with library growth but with absolute size. Using an acceptable rank order of academic quality for the major institutions in the United States, and plotting this against the absolute size of their libraries in 1960, the correlation is 0.87. However, when the quality rankings are plotted against the rate of growth of the libraries from 1946 to 1960, the correlation is negative at -0.24.

More recent work attempts to give criteria for adequacy in terms of the absolute size of a library's collection. The Parry Report (1967) accepts the suggestion of the Library Association that 250,000 volumes is a minimum size for a university of 3,000 undergraduates, 700 postgraduates, 350 academic staff and 50 subjects.

Comparisons with other research are difficult because terms such as "department", "subject", "subject field", and "field of study" are imprecise. Clapp and Jordan (1965) distinguish between different types of field of study: general undergraduate, honours undergraduate, master, and doctorate, but it is not clear what a field really is. If we assume that Parry's "subject" is the same as Clapp and Jordan's "master's field", then Clapp and Jordan consider that a university such as Parry describes should have 291,000 volumes. Both figures are based on the judgment of knowledgeable people, so the similarity in the order of magnitude is significant since the people are not the same in each case.

However vague we leave the term "field", there is also agreement that it is the number of fields which is the crucial determinant of size if a library is to be adequate. Expert judgment is supported by statistical studies.

Dunn, Seibert and Scheuneman (1966) find the following medians of annual correlations for 58 college and research libraries in the United States between 1951 and 1964:

between volumes held and	
number of Ph.D. degrees granted	0.63
graduate student enrolment	0.37
total enrolment of university	0.18

Perhaps the type of student is a less ambiguous quantitative indicator than "field of study". The greater the homogeneity of a group, the smaller is the correlation between numbers in the group and volumes held in the library. This tallies well with Clapp and Jordan's judgment on the increasing number of volumes necessary to support fields of study as one moves from general undergraduates through honours and masters to doctorates. Extending this further, one would expect the greatest heterogeneity to be amongst members of the academic staff.

The influence of numbers of academic staff (or "numbers of faculty",) on volumes held is illustrated by the results of Reichard and Orsagh (1966). Taking 1200 academic institutions in the United States in 1952 and again in 1962, they find the relationships between volumes held (V), number of undergraduates (U), number of graduates (G) and number of faculty (F) to be

$$\begin{array}{llllll} V_{52} = & 51{,}700 & - \ 105U & - \ 37G & + \ 1640F & \\ & & \ \ (11) & \ \ (23) & \ \ (100) & \\ & & & & & R^2 = 0.71 \end{array}$$

$$\begin{array}{llllll} V_{62} = & 27{,}100 & - \ 9.1U & - \ 59G & + \ 969F & \\ & & \ \ (5) & \ \ (19) & \ \ (63) & \\ & & & & & R^2 = 0.75 \end{array}$$

Although R^2's are high and the standard errors reasonable, these regression equations are exaggerated by multicollinearity: the relationships between U, G and F are stronger than the relationships between any of these variables and V. Nevertheless, the coefficient for F is large, and the signs of the coefficients for U and G are actually negative, so without putting too much reliance on the numbers they still show the dominant influence of academic staff compared to students.

Library adequacy depends far more strongly on the number of fields of study than on the number of users. As a university increases in size, there is an increasing opportunity for new fields of study to be pursued with adequate library facilities. As the number of fields increase, so does the amount of overlap between one field and another, and as a result additional fields need a smaller addition to the bookstock than would be the case in a small university. One would expect that the rate of growth of the bookstock would be less for a large than for a small university, and Piternick's findings confirm this.

In small universities a large number of fields of study can lead to low quality bookstock. But decisions about fields of study are not taken by the library. They are taken by the university senate or council. If the university wants an adequate bookstock, it is faced with a choice between the near impossible task of raising several million pounds for its library, and the difficult but possible task of limiting the number of fields of study.

The universities may be right to proliferate new fields of study. As J.D. Bernal (1967) re-iterated recently, the breakthroughs occur between or beyond existing fields of study. However, these fields are new to the world, not just to the universities. They do not put a strain on library resources because the total world literature on such subjects is small. New fields may tax the library's user-services but not the book funds. The strain on book funds comes when a university goes into fields are are new to it, but not to the world.

Summary

Since the university funding depends mainly on student numbers, university decision-takers must make one or more of the following choices, whenever it is decided to add an extra field of study.

1. Library adequacy can be traded against numbers of fields, an increase in one being matched by a decrease in the other.

2. A larger proportion of university funds can be devoted to the library, at the expense of residential accommodation and social facilities, or staff-student ratios, or expensive equipment.

3. Student numbers can be expanded *pari passu* with the number of fields so that income increases at the same rate as the cost of maintaining adequacy.

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Appendix 3

Weeding the Bookstock: The Ungrasped Nettle

It is frequently stated that growth is a major problem for university libraries: it is almost as frequently accepted that the only solution is to build bigger libraries to cope. The standard practice is to estimate, or guess, when the present library building will become full, and then to plan a new one which will "last" for 20 (or 40, or whatever) years. Sometimes this period itself will have elapsed before the new building is constructed, with inevitable consequences. This problem is not peculiar to Britain: witness Cornell University, where the library was reported full in 1929, and a new building was not provided until 1961 (Reichmann, 1962). The fact that during this period the bookstock not only continued to grow at 5% per annum, but was also largely re-classified, speaks volumes for the traditional humility of librarians.

The growth phenomenon becomes a problem because of the prestige apparently attached to the absolute size of university libraries. Although quality may be the watchword, inspection of the shelves of any university library will reveal many books that should not be there: it seems to the outsider that quantity comes first, and that the librarians will start worrying about quality when they reach their first million. It is worth asking at this stage who does judge a library by the size of its bookstock. It is possible that the librarian fears that the library's status will be lowered in the eyes of his own institution if the bookstock decreases in size. The U.G.C. have fostered this idea by giving special grants to the technological universities to enable them to build up their stock to 80,000 volumes (an aim which could easily be achieved by purchasing cheap books of low quality).

If "quality" is realistically interpreted, a continuing revision of the bookstock is necessary. A controlled policy of weeding makes the bookstock more meaningful to users; a secondary consideration is that it alleviates crowding and may actually save money. The decisions to be made are shown diagrammatically (Fig. 1).

In practice, no single solution will be ideal: a weeding policy will aid the decision-takers in their choice of the best possible combination of alternatives. Such a policy will naturally take account of the users' needs, the objectives of the library, the size of the library and its rate of growth, the quality of the bookstock, the economics of book storage, and the national library system. Most of these factors are inter-related in one or more ways.

Users' needs

This is not an attempt to review the vast literature of surveys of the use of libraries and information services. These surveys, and experiments in providing special services to selected groups of users, can provide pointers to the needs of users, and yield ideas on the provision and organisation of library services and facilities. There is a danger in relying on surveys of library use, in that demand is very often conditioned by supply; the theoretical base afforded by a consideration of Zipf's law may prove useful in this area (Buckland & Hindle, 1969). There are a number of quantitative studies concerned with describing and predicting the use of books; the more useful ones go beyond the mere calculation of averages (Buckland & Woodburn, 1968; Jain, 1968; Morse, 1968).

Objectives of the library

The objectives of the library should be related to the objectives of the university: the latter are usually left unstated, so that each member of the institution is free to interpret them as he or she will. This aspect of academic freedom seems designed to guarantee the maximum possible frustration.

Not many librarians appear to have seized the opportunity of drawing up their own definite statement of objectives, and then implementing a policy designed to achieve them. Two policies are necessary: one which is ideal, and another that is possible with existing funds. Written statements of this kind may have the desirable effect of stimulating a re-appraisal (and even a rationalisation) of the present position and function of universities. Some guidelines for both objectives and policy are readily available (Jolley, 1962; Line, 1968 and 1969).

If the concept of a library as a purveyor of information rather than a "mortuary of the intellectually dead" (Fawthrop 1968) gains wider acceptance, weeding will be seen to be feasible. The argument that staff are not available for discarding books wears thin when such major projects as re-classification or automation are considered possible.

Size of the library and its rate of growth

A variety of quantitative measures of library adequacy have been propounded, and are reviewed in Appendix 2. The dangers inherent in the mere counting of books should be obvious to all. The librarian's policy statement will indicate the subject fields in which the library can afford to be adequate: the list may well be a lot shorter than the list of subjects taught in the university and should have an awakening effect on the higher authorities.

Quality of the bookstock

A rational acquisitions policy will lead to a bookstock of high quality - that is, pertinent to the requirements of its users. The quality is maintained by a continuing review of the existing stock and its use, followed by weeding according to properly developed criteria (see below).

Economics of book storage

A common line of attack is concerned with costs (e.g., Simon, 1967). The variability between libraries makes these exercises inconclusive in the extreme, particularly as the costs of delay to the user are usually ignored. A recent study (Lister, 1967) isolates some of the implications of storing little-used material, but it is not yet possible to measure the costs of delay to the user in retrieving books from the store.

The cost of library buildings is variously quoted as from as little as 5/- per volume to as much as 35/- per volume, or more: the discrepancy must lie in different bases of comparison. It may well be cheaper to weed than to build a new library; in many situations it will be cheaper to obtain a book on inter-library loan than to store it.

National library system

Remote storage of books is hardly necessary in Britain where inter-library loan facilities are comparatively well-organised. If the recommendations of the Dainton Committee (N.L.C., 1969) are effected, the National Lending Library could collect discarded books in the same way as it collects discarded periodicals. This would ensure that the material was still available.

Criteria for weeding

Given that a librarian accepts the principle of discarding (non-university libraries have been doing it for years), a number of criteria are available to assist the process. The cost of item-by-item selection by professional staff is high and too rigid an application of rule-of-thumb can lead to weeding inefficiency. A two-stage process is necessary. Comparatively unskilled labour can be used for selecting books of a certain age or with a certain rate of use (Trueswell, 1966; List, 1967; Jain, 1968). (Recently at Lancaster University, 10 students were employed for 2½ days to identify and process all books in the library which had achieved a given rate of use; so the costs for the complementary exercise, weeding the little-used books, obviously would not be prohibitive, even in a longer established library.)

A second stage would be the examination of these previously selected books, bearing in mind the resources available for studying particular disciplines within the university (cf. Ash, 1963). Again, the exercise is not impossible if managed in the right way: at Bristol Universities weeding is done annually and the day-to-day work of the library proceeds normally.

Periodicals pose a different problem: the half-life concept can be applied to determine the lengths of run to be retained of different periodicals (Brookes, 1969). Data collection may seem tiresome, but it can be simple and inexpensive.

The concept of a core collection of optimal size, satisfying a specified percentage of users' requirements (Trueswell, 1966) is perhaps valid only in "large" academic libraries, in which a certain amount of substitutability is possible between books. (Since inadequate stock leads to disappointed users, who will then place fewer demands on the library, supply tends to create its own demand, so that about the same percentage of demand may be satisfied in all libraries, regardless of the adequacy of the stock.) It seems more likely that there is in fact a maximum absolute size of library which is suitable for users, and that in a large university the library may need to be divided into teaching-oriented and research-oriented sections (Ratcliffe, 1968). The words of Arundell Esdaile spring to mind: (Speaking of the British Museum) "Free or open access can hardly be practised in so large a library as this. As it was once put, the danger would be not merely of losing the books, but also of losing readers."

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A recent review (Cooper, 1968) cites some 35 items concerned with weeding library collections: only 3 of these were by British authors. This may indicate the regrettable insularity of a professional writing on his (or her) own ground, or a paucity of published works by British librarians. If the latter cause is true, this poses the question why? Are the British too busy weeding to write? Have libraries been so starved of book funds that weeding is as yet considered unnecessary? Or is the humble librarian too scared to grasp the nettle?

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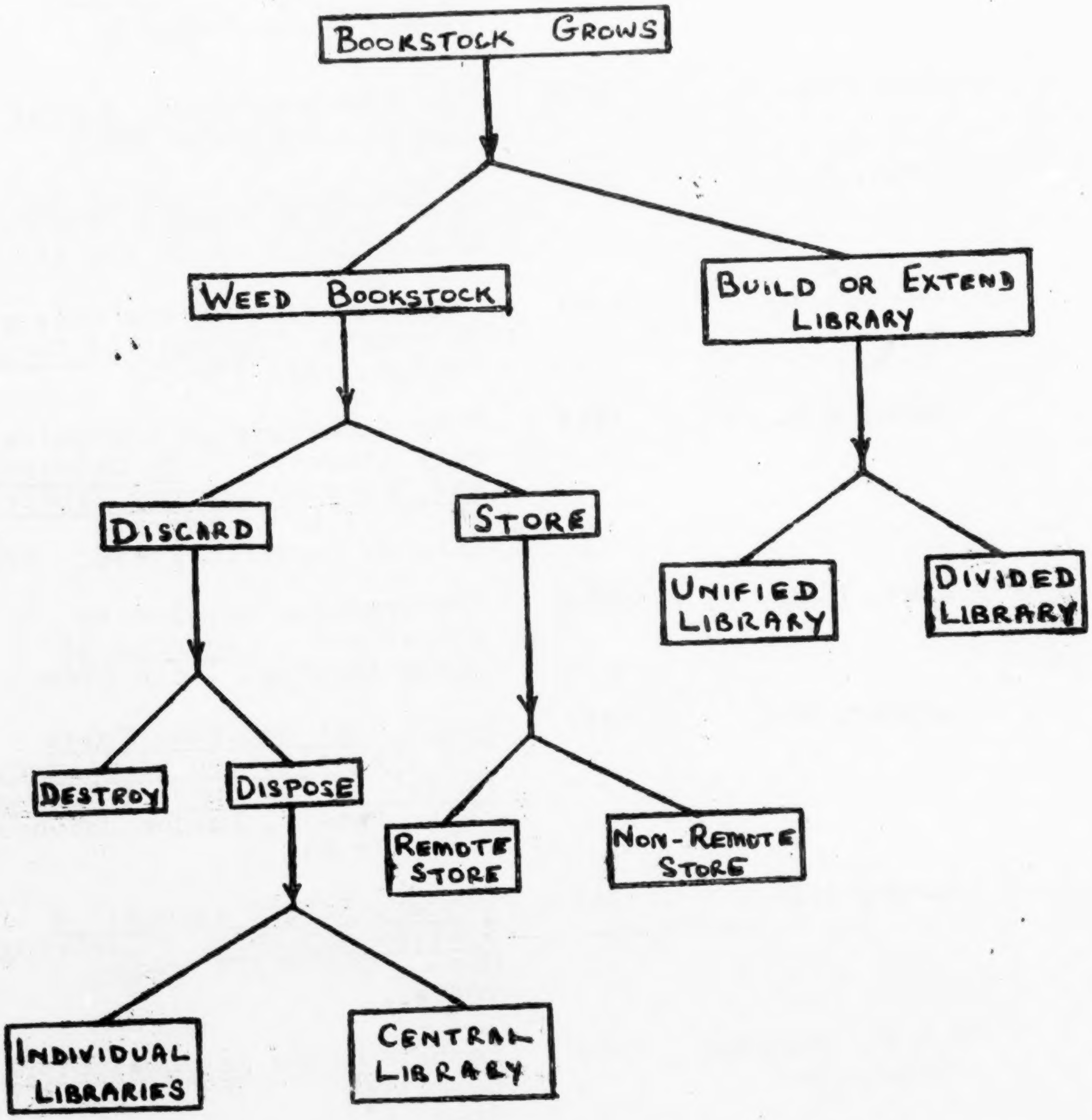
Fig. 1

Some alternative solutions to the growth problem.


BOOKSTOCK GROWS
WEED BOOKSTOCK
BUILD OR EXTEND LIBRARY
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UNIFIED LIBRARY
DIVIDED LIBRARY
DESTROY
DISPOSE
REMOTE STORE
NON-REMOTE STORE
INDIVIDUAL LIBRARIES
CENTRAL LIBRARY

Appendix 4

Some Welfare Economics

a) Benefit with or without consumer surplus

In Chapter 3, the hypothesis was put that librarians equate, roughly and intuitively, the ratio of marginal costs to the ratio of marginal benefits. This appendix points out a problem in the use of the concept "benefit" in small organisations where consumer surplus is relevant to many decisions.

In the theoretical case where the library's services are sold and where the distribution of output is considered satisfactory, there are two possible pricing policies. The library service can be provided up to that level where marginal cost equals price (the "strict" condition for optimal provision). Alternatively, if there is a uniform degree of monopoly throughout the community, or if the state takes a proportionate surplus from the sale of each good and service, the more "lenient" condition applies: the ratio of the marginal costs should equal the ratio of prices ("strict" and "lenient" after Dobb, 1969, p.73).

We have managed to side-step the distribution problem by assuming that trade-offs are decided by a political process within the university committee system, thereby taking into account preferences about who should use the services provided as well as what services should be produced. "Second Best" problems are ignored in this theoretical note since they can only be solved empirically. This still leaves two problems: which marginal cost should be used, and what do we mean by "benefit"?

There is little conceptual difficulty over marginal cost. It is based on opportunity cost, which in turn can be found from the market prices of those factors which could have been put to other uses during the relevant planning period. (Adjustment for market imperfections or disequilibria may be necessary to get accounting prices.) Actual measurement is a formidable task. We used short run marginal costs which we assumed to be constant. "Short run" in this context means a period of up to two years. For a production unit such as a university library this is a very short planning period. However, the library is forced to concentrate on the short term by the lack of informative long term plans at the national and university level.

The conceptual problem arises over benefit. In Chapter 3, marginal benefit means the additional usefulness of an additional unit of library services, an intuitively reasonable approach. Benefit refers to value-in-use, as it should do in a small non-market organisation with an established and pervasive communication network (perhaps more pervasive than efficient). We are assuming that university decisions are taken with some awareness and assessment of consumer surplus.

We used marginal benefit as a tool for describing an "as if" situation: if the marginal rate of substitution in production is known, we can say that decision-takers are behaving as if the marginal rate of substitution in consumption were the same. However, when these two rates of substitution are equal they are also equal to the ratio of accounting prices. So the ratio of marginal benefits (in our sense) is the same as the ratio of accounting prices.

The more usual approach in the literature is to use "benefit" as analogous to revenue. Total benefit is accounting price times quantity, and average benefit is analogous to value-in-exchange (though not identical since the goods and services may not be exchanged). Total benefit in our sense is analogous to the revenue of a completely discriminating monopolist. This is a point which often leads to confusion (for example: Niskanen, 1968). Some formal definitions may clarify the distinction.

Let B represent total benefit including consumers' surplus, then $\frac{dB}{dx}$ is marginal benefit, the relationship between accounting price and the quantity produced

and $\frac{B}{x}$, average benefit, is little used except in some sense of mathematical expectation.

Let V represent total benefit excluding consumers' surplus, then $\frac{dV}{dx}$ is marginal benefit which is little used

and $\frac{V}{x}$, average benefit, is the relationship between accounting price and the quantity produced.

Now $\frac{dB}{dx} = \frac{V}{x}$ since both give the accounting prices

and $\frac{V}{x} > \frac{dV}{dx}$ when the second order conditions apply

so $\frac{dB}{dx} > \frac{dV}{dx}$

and $B \left(= \int \frac{dB}{dx}\, dx \right) > V \left(= \int \frac{dV}{dx}\, dx \right)$ over the same range for x

or $B \equiv V$ + consumer surplus, as stated.

Whether B or V should be used depends on the information network of the organisation concerned. If individual consumers' preferences are known to decision takers and will influence their decision, use B. If an organisation is large and relies on prices as a summary of information, the more usual case, then use V. It all depends on what information the decision-takers use.

b) The choice of optimising techniques

Three possible approaches to library planning are cost accountancy/market research techniques, cost-benefit analysis and cost-effectiveness analysis. In this section we give the reasons for rejecting the use of these techniques as a way into the problem; we show why the inverse programming method seems preferable and finally we show how inverse programming can be integrated with cost-benefit analysis in a way which is relevant to decisions.

A rough idea of some of the benefits from university libraries can be obtained by taking certain easily isolated activities and finding out how much the beneficiaries would be prepared to pay to avoid losing such activities. The method is shown in Chapter 7. The amount that people would pay to keep the service is compared with the costs. The costs of such a service are fairly easy to assess: labour costs plus some small but necessarily arbitrary figure for such overheads as the rent of the office. Because overheads are a minor part of the costs, the arbitrary nature of this costing is not important.

There are very few library activities which can be isolated and assessed in this way. The library is a complicated system where nearly everything interacts with everything else. There are certain physical resources and a fixed budget. Each activity uses several resources and each resource contributes to several activities. The problem of the efficient allocation of these resources is a complex one. A solution to a part of the total problem may give a false sense of achievement, but in reality can make matters worse. For example, a demonstration of the worth of an information service may lead to a diversion of librarians to this work and away from processing new purchases. This diversion can cause a delay in processing which gives a geater loss in benefit than the increase due to the information work. Problems of this type, where a solution to part of the problem suggests policies which can make the whole system worse, have been aptly called by Churchman "wicked problems."

(From discussions with colleagues and at seminars, we feel that a comment is necessary on sub-optimisation and "Second Best" solutions. Until the impossible happens and economists and operational researchers develop a theory of the world, all solutions to problems run the risk of being sub-optimisations and second best. These solutions may, however, recommend actions which lead to an improvement over the present situation even if they are not *the* best solutions. There are plenty of sub-optimising solutions which are not glib wrong answers to the wicked problems described by Churchman. Nobody who is infatuated with the *optimum optimorum* would even dirty his hands with a real problem.)

Costing the library depends on what the costings are for. Most of the activities of the library depend heavily on fixed resources: the building, the bookstock and librarians who have developed skills specifically useful in the particular library. The costs which appear in the accounts are the money costs for salaries, maintenance and increasing the stock. In allocation problems the benefit foregone is the relevant measure, not the money costs. Money costs are only relevant for allocating the annual budget, but the budget is only a small part of the library's resources.

These difficulties of isolating activities to assess their costs are matched by difficulties in isolating benefits. Many activities of the library either complement or substitute each other, so the value of one depends on the quantity of another. For these reasons the techniques of the cost accountant and market researcher have only limited applicability.

Cost-benefit techniques lead to a different set of problems. From the cost side libraries are not *proposed* investment projects but productive enterprises which already exist and function. The market value of these assets is relevant in two circumstances only: if it is proposed to reproduce an existing library, or if it is proposed to scrap an existing library. Each circumstance will give very different estimates of value, and both are irrelevant to the problem in hand, which is how to get the maximum benefit from the existing assets of buildings, staff and stock of information.

From the benefit side, libraries provide services which contribute to the production of educated people and research. In Chapter 8 we show that different types of education and research place different demands upon the library. A survey of the Economics of Education suggests that decisions about the university's "product mix", and hence the emphasis to be put on the particular activities of the library, are decisions that will be based on judgment rather than analysis for many years to come.

Cost-effectiveness techniques suffer from the same faults on the cost side as cost-benefit analysis. On the effectiveness side, these techniques require that many objectives be listed in terms of probabilities of success for each objective. Decision-takers find it difficult to grasp such concepts at all, and almost impossible to weight the relative importance of such objectives when stated in probabilistic terms.

Some of the activities of the library are immediately of benefit to users, but there are other activities which create a feeling of comfort in users because they know that the library is likely to be helpful if and when it is needed. These "insurance" activities which anticipate users' needs might lend themselves to a cost-effectiveness approach, but we consider that the technique presented in Chapter 3 takes the benefits of insurance into account by using the judgment of decision-takers. An intuitive start at cost-effectivness is the idea of the "90% library", but this does not treat the separate activities of the library in the detail necessary for university policy. No detailed costings are available for such libraries.

It seems that libraries use resources whose market price is irrelevant in the short run to produce services whose market price is unobtainable. In these circumstances the analysis must be carried out in terms of physical quantities giving the relationship between resources and activities. The problem is how to find the weights which policy-makers place on the activities.

Koopmans (1957, p.100) discusses allocation problems involving multiple objectives for which no market valuations exist to establish comparability, while at the same time several scarce resources are required to serve these objectives. He suggests "arbitrarily establishing comparability of desired activities by the adoption of tentative equivalence ratios based on judgment. This is tantamount to declaring at what relative prices the policy maker will trade one desired activity for another, no matter what net output bundle resulted from the trade, if only it frees some resources for a further increase in some output. The tentative equivalence ratios can then be revised by trial and error if they seem out of Kilter with the particular net outputs resulting from an "efficient" bundle of activities computed on the basis of these ratios." Marglin (1967, ch.1) adopts a somewhat similar approach. Koopman's "tentative equivalance ratios" depend on the judgment of the analyst. Marglin's approach involves explaining to the policy-maker the various production possibilities, a difficult task when there are more than two activities.

The inverse programming approach avoids these two disadvantages. By making use of the fact that the library already exists and functions, the equivalence ratios implicit in the decisions already taken by the policy-makers can be made explicit. The analyst does not have to use his judgment on policy matters. Nor is it necessary to explain the complicated range of production possibilities to the policy maker: the implicit equivalence ratios take production possibilities into account. The ratios provide a summary of the relevant information.

The operational researcher generally starts by asking "What do you want to do?" and then sets about finding the most efficient way to do it. Inverse programming assumes that what is being done is being done efficiently and then says "This is what you seem to want. Is this really the case?"

The blend of activities that the library is producing is observed and compared with the various alternative blends that could be produced. The fact that one blend is chosen in preference to others implies that the value of the outputs are weighted in a certain way. The policy-makers are then presented with the weights that are found and asked if they agree. If they revise the implied weights to a significant degree, this suggests that a change in the blend of outputs would be preferred. The approach has a number of advantages. It is the only approach known to us which fits in with the existing decision structure. It conveys information concisely since it classifies and quantifies activities in a way relevant to decisions but also weights the activities.

It is plausible to expect that as many activities increase, so the value of each unit of that activity will decline. Therefore the process of calculation must be repeated. However, the calculation is cheap to do.

Changes in the quality of the activities should be reflected in changes in the value which decision-makers place on the activities. Provided the calculation is repeated from time to time, there is no danger of concealing quality changes within an incorrect quantitative measure.

Although the assumptions of linear programming are unrealistic, the technique has given spectacular results with such complicated production units as mixed farms. One suspects that library operations are more routine than farming, that there is less range of choice of possible activities, and that the fixed resources are better recorded.

The success of the LP approach is due to the mathematical properties of the solution, rather than the assumptions necessary to make the model relate directly to the world. If there are few activities, a wide range of values will lead to the same solution. If there are many activities, changes in the values will lead to changes in the solution but the changes in the solution will be small. The results are good approximations. Unfortunately, the wide range of values which could lead to the same result present a problem in arriving at the "correct" weights. We adapted a suggestion of Feldstein (1967, p.96) for the conceptually similar productive unit of a hospital where he suggests that "although the relative social values 'in use' of different case types cannot be measured, it might be a rough first approximation to accept their relative average costs as a measure of the relative values of additional treated cases."

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Appendix 5

Guide to the Data

1. Introduction

Throughout this chapter, reference by page number only, is made to the descriptions of the surveys in Chapter 6, "Data collection methods", of this report. Some general points concerning the data are dealt with first.

The original cards, forms and questionnaires for each survey are still in existence and are stored in Durham. Data from most of these has been coded and transferred to media more amenable to analysis. The "coding lists" referred to by number are sets of coding instructions which are filed (with the survey analyses) in the Department of Computing at Durham University. The code numbers used in this chapter to identify particular surveys (e.g. C9D, H7N) are explained in chapter 6; the analyses which have so far been carried out on the data are held at Durham in files identified by the survey code numbers, and are thus listed here under the particular surveys.

Some of the data is noted as being "on magnetic tape". This refers to a 600 foot tape on the Newcastle University KDF9 computer. This tape is identified as follows:

Name:	R.N. Oddy
Serial Number:	.28.0003
Rack:	J3

The data from this tape will in due course be transferred to permanent storage on the NUMAC I.B.M. 360/67 computer.

Some data is recorded "on punched cards". These are 80-column cards, which are I.B.M./I.C.L. compatible.

Programs used for analysis are referred to by name, and are briefly specified in Annex A. Fuller details are kept with program listings in Durham.

2. Instant diary surveys

A1D, A2D, A3D Durham University Libraries - General Use, November 1966 (one week)

This group of surveys is described in Chapter 6 para 1(a) with Annexes 1 and 2. The data from the pilot survey at the Science Library was tabulated for interest only; the data from the three main surveys is on magnetic tape. Coding list 1D was used with additions specified in notes on program CSDCS. The data was analysed, using program SGIAP, to establish a basic pattern of use, and to attempt to isolate some of the factors affecting use.

(a) Average time spent in each library

    (i) by undergraduates - arranged by college
                          - arranged by course of study

    (ii) by research students and academic staff - arranged by department

    (iii) by others - administrative staff, external borrowers, etc.

(b) Numbers of each category of user performing each of the activities listed on the form

(c) Numbers of undergraduates performing specific tasks - arranged by college

(d) Multiple visits - numbers of each category of user making 1, 2, 3 etc. visits to the library on a single day

(e) Numbers of users (undergraduates and others) leaving each of the libraries just before lectures commence

(f) Number of users entering libraries just after lectures finish

(g) For each day of the week, the number of users in each category visiting each library

(h) General activity analysis, showing to what extent any one activity in the library is combined with any other

(i) For graduate students and academic staff of each department, the following ratios:

Number of visits per member of department

Number of books sought per visit

Number of book borrowers and book returners per visit

Number of books sought: number of book borrowers and book returners

(j) Plots of the following ratios

- for undergraduates, against distance of college from library
- for graduates and academic staff, against distance of department from library:

Number of visits per member (of college or department)

Time spent in library per visit

Number of book transactions per visit

Number of book borrowers: number of book searchers

A12D, A22D, A32D Durham University Libraries: General Use, May 1967 (one day)

These were the follow-up surveys to the above, and the data is likewise stored on magnetic tape. All of the analyses listed above can be produced, using program SGIAP. This program demands a knowledge of KDF9 user-code and at one stage during the project this knowledge was lacking. When some information was required quickly, it was simpler to punch some of the original data onto cards and to write a program in PL/1 which would produce the required information. So this was done for all three surveys using this format:

Columns 1 to 16 on punched card corresponding to numbered boxes on survey card: punch 1 if box is ticked, otherwise leave blank

Column 17: punch number of previous visits to library, as recorded at the foot of the survey card

These cards have been analysed using program A12D.

(a) Numbers of each category of user performing each task

(b) Numbers of each category of user

(c) General activity analysis showing the extent to which any one activity was combined with another (A22D only)

(d) Catalogue use linked with borrowing - the users who used the catalogue and borrowed books on the same visit, compared with those who used the catalogue. (A22D only) Other links of this kind can be extracted from the general analysis.

F1D, F2D Durham University Libraries, Qualitative Unrecorded Use, Nov 1967 (one day)

These surveys are described in Chapter 6 para 1(b) with Annex 3, and in Appendix 8. The data has been transferred to punched cards, using coding list 2D. A difficulty arises with the analysis of this data, which was not foreseen at the punching stage. The codes used for "College", "Course", and "Department" are 1-, 2-, and 3-digit codes, and these were not punched according to a fixed format. This would not matter when using PL/1 for programming for analysis, but for the fact that the codes for the answers to questions 11 and 12 on the survey card are alphabetic in the case of the Arts/Social Sciences Library (F1D). The programming difficulties arising from this are such that it would be easier to re-punch the data if any analysis involving questions 11 and 12 were required.

Analyses so far done are

(a) An indication of the percentage of users not using library stock. This was derived from those cards revealing the following combination of responses:
question 8 Yes
question 10 No
question 11 No response

(b) A matrix summarising the replies by undergraduates to questions 7 and 9 - from where they came to the library, and where they went from the library. (F1D only) This matrix could also be produced for survey F2D. The program used is called F1D.

K1N Newcastle University Library. General Use.
Feb 1968 (two days)

This survey is described in Chapter 6 para 1(c), with Annex 4, and in Appendix 8. The data has been punched on cards using coding lists 1N, 6N, 8N and 9DN. All analysis has been done by computer, the relevant programs being CHECKD, NSDSK, NSDATA, NSD2 and NSTIM.

(a) For each 15-minute period of the day, the numbers of each category of user entering the library

(b) For each 15-minute period, the numbers of each category leaving the library

(c) Mean time spent in the library by each sex

(d) Mean time spent in the library by each category of user

(e) The numbers of each category of user

(f) The numbers of undergraduates in each year of study

(g) The mean time spent in the library by students following each course, and by research students and academic staff in each department

(h) The numbers of users from each course and department

(i) The mean time spent on performing particular activities (items 6 to 14 on the survey card) by users who performed that activity only

(j) The mean time spent in the library as a function of the distance travelled to and from the library

(k) The number of users in each category performing each activity

(l) Multiple visits - the numbers of users in each category making 1, 2, 3 etc. visits

(m) Multiple visits - the numbers of users from each course and department making 1, 2, 3 etc. visits

(n) Proportions of users from each course and department performing each activity

(o) Mean time spent in the library as a function of the category of user and the number of previous visits made to the library

(p) Activities performed as a function of the category of user and the number of previous visits made

K4N Newcastle University, eight Dept. Libraries. General Use. March 1968 (one day)

This group of surveys used the same form as K1N (see above). The coding and programs are identical with those used for K1N, and the same analyses can be produced. This has been done so far with the returns from the Geography Library only.

M1D, M1N, M2D Durham & Newcastle University Libraries. Quantitative Unrecorded Use. May 1968 (one day)

These are described in Chapter 6 para 1(d) with Annex 5. The main points arising from this survey are covered in Appendix 8. The data is held on punched cards, coded according to lists 4DN, 6D, 6N, 8D, 8N and 9DN. Programs used for the analysis were DATACHECK and MAY68A. The supplementary data on the age of books used in Durham Science Library is also on punched cards (coding list 5D), and has been analysed using program M2D.

(a) Mean time spent in each library and mean number of books used by each category of user

(b) Mean time spent and mean number of books used by users from each course and department

(c) Frequency distribution of the number of items used by students in each year of study

(d) Frequency distribution of the length of visits to the library by students in each year of study

(e) Frequency distribution of the length of visits by users from each course and department

(f) Frequency distribution of the number of items used by users spending specified amounts of time in the library

(g) Frequency distribution of the number of items used by users from each course and department

(h) Number of users using 0, 1, 2, 3, etc. items on the 1st, 2nd, 3rd etc. visit

(i) Age distribution of books and periodicals used in Durham Science library, arranged by class number

3. Postal questionnaire surveys

B6D, B8D Durham University Staff & Research. Term time week activity. Nov 1966.

These are described in Chapter 6 para 2(a), with Annex 6. The data is stored on magnetic tape, coding being according to list 1D, with some additions specified in the notes on program TASSR. The main purpose of these surveys was to obtain information on which to base a further survey (D6D), and no tabulations have been produced.

D6D Durham University Staff. Vacation week activity. Apr 1967.

This survey is described in Chapter 6 para 2(b), and Annex 7. Analysis of this data has been done manually from the original replies.

(a) Use of libraries outside Durham during vacation (information submitted to the Dainton Committee)

(b) Ranking of information sources by members of different faculties

G9N Newcastle University Undergraduates (20% sample) Termtime week and general use. January 1968.

This is described in Chapter 6 para 2(c). The data has not been coded, but some analysis has been done manually. Simple counts have been made of the replies to most questions, according to the subject group and year of study of the respondent. The subject groups correspond in most cases to the existing faculties, except that Pure Science has been divided into Physical and Biological Sciences. The counts were made separately for each sex.

(a) Question 4: place of residence

(b) Question 7: frequency of use of libraries

(c) " 8: books on loan from various libraries

(d) " 9: choice of library when seeking specific books

(e) " 10: a measure of persistence

(f) " 11: second choice of library when seeking specific book

(g) " 14: borrowing from "other" departmental libraries

(h) " 15: use of inter-library loan service

(i) " 16: choice of library when seeking books on specific subjects

(j) " 17: second choice of library when seeking books on specific subjects

(k) " 18: occurrence of serendipity in various libraries

(l) " 19: methods of searching for books on a given subject

(m) " 20: choice of location for working quietly

(n) " 22: times of day when libraries are used

(o) " 23: purposes for which libraries are used

(p) " 29: frequency of consultation of library staff

(q) A variety of ratios has been calculated, relating to questions 7 and 8.

See also the notes following J6N, below.

H7N, H8N Newcastle University. Junior Staff. Postgrad. students. Term time week and General Use. Jan/Feb 1968

These are described in Chapter 6 para 2(d). Again these forms have not been coded, and some manual analysis has been done.

(a) Question 9: frequency of use of various libraries by members of particular faculties (H7N only)

(b) " 10: "average rank" of various libraries as sources of material for each faculty (H7N only)

(c) Question 11: tabulation of libraries outside Newcastle used for research purposes by members of each department

(d) " 19: use of inter-library loan service by each department

See also notes following J6N, below.

J6N Newcastle University Staff. Termtime week and General Use. February 1968.

This survey is described in Chapter 6 para 2(e). Again, analyses have been done directly from the original forms.

(a) Question 4: frequency of use of various libraries by members of particular faculties

(b) " 5: "Average rank" of various libraries as sources of material for each faculty

(c) " 6: tabulation of libraries outside Newcastle used for research purposes by members of each faculty

(d) " 13: use of inter-library loan service by each department

(e) " 22: ranking of information sources by members of each faculty

Notes on surveys G9N, H7N, H8N and J6N

A list of desirable correlations and analyses has been prepared, and is filed with the analyses for survey G9N.

A subset of the questionnaires from these surveys is being analysed by Miss Lois Gray of Sheffield University, for the purposes of an M.Sc. thesis. These are the questionnaires returned by students and staff in the Departments of Bio-chemistry, Botany, Physiology and Zoology, and the Faculty of Agriculture.

4. Interview questionnaire surveys

C9D Durham University. Undergraduates. Termtime week and General Use. Nov/Dec 1966.

This survey is described in Chapter 6 para 3(a) with Annex 9. The data has been coded (coding list 1D, with additions as specified in the notes on ISDcS) and stored on magnetic tape. Part of the data - identification data, and responses to question 2 - is also stored on disk on the NUMAC computer. Some of the data on magnetic tape has been analysed using program SGIAP, other analyses have been made manually from the original questionnaire returns.

(a) Question 2: tabulation of grouped data - amount of time spent on any one activity in conjunction with that spent on any other

(b) " 4: tabulations for each college and faculty of the number of visits made to various libraries

(c) " 7: tabulations for each college and faculty of the "confined" books used in the library and borrowed on overnight loan

L6D, N6D Durham University, Staff S.S. Depts. Current-Awareness. March 1968 and June 1969

These surveys are written up in chapter 7, "A Current Awareness service for social scientists", of this report.

5. Loan records

The collection of data from loan records is described in Chapter 6 para 4. The data falls into three main groups:-

(1) Durham University Arts/Social Science Library - books returned from loan in the year August 1967-July 1968

(2) Durham University Science Library - books returned from loan in the periods

    (a) August 1966 - July 1967

    (b) August 1967 - July 1968

    (c) August 1968 - December 1968

(3) Newcastle University Library -

    (a) books returned from loan during the period October-December 1967

    (b) books on loan as at 10 March, 1968

All this data, with the exception of items 2(a) and 3(a), is held on punched cards. The 1966-67 data from the Durham Science Library is on magnetic tape (coding list 3D), and has been tabulated by class number of book and status of borrower (all analyses performed on loan records are held in the file "Overlap Studies" at Durham University Computing Department). The 1967

A5.10

Newcastle data has been tabulated by class number of book and department of borrower, and summary "overlap" matrices have been produced. This analysis was done by hand.

(1) Durham Arts/Social Sciences Library, 1967-68

Each loan is represented by a single card. These cards are in groups, the first card in each group being a code card to indicate the class numbers of the books in that group. Coding list D gives the codes and the Dewey class numbers which they represent. The cards for each loan have data punched in 5 fields as follows:

number	status	identifier	data borrowed	date returned
1	2	3	4	5

Field 1 (number): a simple running number for the cards in a particular group. Useful as a check on correct punching. The number is followed by a colon.

Field 2 (status): (i) the status of the borrower, as follows:

1. undergraduate
2. research student
4. academic staff and external borrower

OR (ii) the status of the book:

8. books consulted in the library

Only one of these alternatives is possible in field 2.

Field 3 (identifier): a code for the college (for undergraduates) or department (all others). Coding list 1D is used.

Field 4 (date borrowed): date on which the book was borrowed. This takes the form day/month/year, each item being a 2-digit number, thus: 12/12/67
05/01/68

Leading zeros are not always punched, but a blank appears where the zero is absent.

Field 5 (date returned): date on which the book was returned. Exactly as for Field 4, save that a semi-colon follows the last figure.

Two formats were used for punching, the second becoming necessary due to the sheer mass of data.

Format 1:

Field	1	commencing	in	column	1
"	2	"	"	"	5
"	3	"	"	"	10
"	4	"	"	"	20
"	5	"	"	"	30
	semicolon		"	"	38

Format 2:

Field	1	commencing	in	column	1
"	2	"	"	"	10
"	3	"	"	"	16
"	4	"	"	"	22
"	5	"	"	"	35
	semicolon		"	"	43

The data is left-justified in the fields, which are filled out with blanks.

(2) Durham Science Library

The data from the Science Library is organised differently. The cards representing books returned from loans are grouped according to the date on which books were returned, and the first card in each group bears this date. Thus, the data fields on the cards representing loans are as follows:-

number	status	class number	identifier	date of borrowing
1	2	3	4	5

Fields 1 and 2 are exactly as for the Arts/Social Science Library: fields 4 and 5 correspond with fields 3 and 4 for the Arts/Social Science Library. Field 3 contains the U.D.C. class number of the book, exactly as it appears on the loan record, albeit without the cutter letters.

(a) August 1967-July 1968

From January onwards, the following format was used for the punched cards:

Field	1	commencing	in	column	1
"	2	"	"	"	6
"	3	"	"	"	11
"	4	"	"	"	30
"	5	"	"	"	36
	semicolon		"	"	44

Earlier data was punched in free format. This data has been tabulated by class number of book and status of borrower, using program FRED.

(b) August 1968-December 1968

This data was punched according to the following format:

Field 1 was absent
" 2 commencing in column 1
" 3 " " " 6
" 4 " " " 25
" 5 " " " 31
semicolon " " 50

A program, DsLOANS, has been written to analyse this data. This provides for the following tabulations:

(i) number of books borrowed from each class by the graduate members of each department

(ii) number of books borrowed from each class by undergraduates

(iii) mean number of books borrowed by the graduate members of each department

(iv) mean length of loan for undergraduates, research students, and others

(v) number of books which were on loan for 0, 1, 2 ... 365 days to undergraduates, research students, and others

(vi) matrix showing the date on which books were returned against the date on which they were borrowed

(vii) tabulation of the number of books borrowed by undergraduates on each day of the Michaelmas term, 1968

The program uses coding list 10D.

(3) Newcastle University, 10 May, 1968

The data is punched in 3 fields, separated by blanks:

identifier	class numbers	semicolon
1	2	3

Field 1 contains the department to which the borrower belongs (coding list 6N)

Field 2 contains the class numbers of the books on loan to that borrower. Each number is a 3-digit Dewey number, and the numbers are separated by blanks.

Program OLAP analyses this data, providing a matrix of the number of books borrowed from each class by each department, the mean number of books borrowed by the members of a department, and the number of borrowers in a department.

6. Turnstile records

Daily readings are available from the turnstile at Durham Science Library for the period September 1966 to December 1967. A pressure-pad device was installed at the Arts/Social Sciences Library and daily readings from this have been kept since April 1967. For the period April 1967 to June 1968 these have been plotted on a graph to indicate the cycles of use.

7. Computer Programs

A list of computer programs used during the project appears on the following 4 pages.

A5.14

TITLE OF PROJECT P.E.B.U.L. (Project for the Evaluation of the Benefits from University Libraries

Program title	Survey	Functions & purpose of program	Machine Configuration	Language	State of Program	Name and address of Programmer
1. CHECKD	Instant Diary Newcastle U March 1968 K1N	To check punching errors, detect missing items of data and invalid items	IBM 360/67 linked with IBM 1130	PL/1	Fully developed	B.W. Bennetto Durham University Business School Old Elvet Durham
2. NSDATA	" "	The main program to analyse the survey. Data stored on cards includes:- time (hours & mins) of entry of library time leaving library M or F: numeric code showing status year of study, areas of library visited, uses made: no. of times library visited that day: distance user travelled to and from library	" Data stored on-line on IBM 2314 Disk Unit	PL/1	"	"
3. NSD2	" "	To calculate the variation in the proportion of uses as a function of the dept.	IBM 360/67 linked with IBM 1130	PL/1	"	"

4. NSTIM	Instant Diary Newcastle U March 1968	Calculates the variation in times spent in the library as a function of: status of user, no. of previous visits, uses made of library. Output Table 1: mean time spent as a function of status & previous visits Output table 2: uses made as a function of status & previous visits	IBM 360/67 linked with IBM 1130	PL/1	Fully developed	B.W. Bennetto Durham University Business School Old Elvet Durham
5. NSDSK	" "	To store certain data onto disk. Program translates data from "instant diary" forms & stores it	"	PL/1	"	"
6. RHOCALC	Statistical Program	To calculate 'r', the correlation coefficient, from raw data, avoiding the need to produce means & standard deviations. Input-pairs of observations	"	PL/1	"	"

7. REGRE	Statistical Program	An IBM Program from the Scientific Subroutine Package. Calculates a multiple correlation coefficient. Whole package necessary for execution since it calls on other subroutines in the S.S.P. Library. It also requires a form of temporary storage (e.g. magnetic drum, connected on-line)	IBM 360/67 linked with IBM 1130	Fortran IV	Standard Package	B.W. Bennetto (user) address as above
8. FRED	Science Library Issue Slips Durham U	Mainline Program. Calls subroutine ANAL with: Class no. of books, type of borrower, type of volume, overnight loan or not, details of borrower, date of return, date of borrowing. Program tabules & at end of data stream, produces: Statistics for time period covered: length of loan by undergrads, postgrads	IBM 1130 with 1442 card read/punch, 1403 Printer 1131 C.P.U.	1130 Fortran	Fully developed	B.W. Bennetto Durham University Business School Old Elvet Durham

		& staff, as the frequency of members returning books one day after loan, two days, etc: Overlap matrix of staff borrowing				
9. ANAL	Science Library Issue Slips Durham U	Subroutine for 8. Reads values from raw data by: (i) end of data? (ii) date card for new batch of data? (iii) numeric code for borrower or confined book, or error message (no code, or code incorrect - corrected form entered at typewriter console) (iv) find class no. & reclassify, with similar error routine (v) college/dept. code or error routine (vi) date of loan	IBM 1130 with 1442 card read/punch 1403 Printer 1131 C.P.U.	1130 Assembler	Fully developed	B.W. Bennetto & S. Holden, Guest Keen & Nettlefold Ltd Computer Centre 53 Uxbridge Rd London W.5
10. MVSTO	"	Subroutine for 9. Manipulates areas or core storage	"	"	"	S. Holden Address as above

11.	Science Library Issue Slips Durham U	The programs 8-10 make use of several programs in the 1130 library, to read in cards & print on console, convert to EBC DIC from its internal binary form	IBM 1130 with 1442 card read/punch, 1403 Printer 1131 C.P.U.	1130 Assembler	Standard packages	B.W. Bennetto (user)
12. OLAP	Snapshot Survey Newcastle U	To tabulate values into an "overlap" matrix. Data in form: status of borrower: loans of library as first 3 letters of Dewey system: end of field marked by semicolon. Program also reads in class nos. corresponding to the Depts., to set class categories to correspond to dept. categories. Output shows table: Dept., total dept. borrowing, staff members with books out, mean no. of books per person, overlap matrix	IBM 360/67 linked with IBM 1130	PL/1	Fully developed	B.W. Bennetto address as above

13. NOV 67	Instant Diary Durham U Nov 67 A1D, A2D, A3D	To check the data punched, to see that: no illegal data items were present, no time exceeded 21 hours (closing time) or 60 minutes, no visit shorter than 1 min. codes for courses etc. were correct	IBM 360/67 linked with IBM 1130	PL/1	Fully developed	Mrs. J. Wenban-Smith Durham University Computer Unit
14. MAY 68A	Instant Diary Newcastle U & Durham U May 68 M1N, M1D, M2D	To analyse data punched on cards from these surveys. Output gives tables showing statistics of visits made on the day of the survey	"	PL/1	Program has been used but desirable to develop further	"
15. DATA-CHECK	" "	To check the data punched from this survey in a generally similar way to 13 above	"	PL/1	Fully developed	"
16. A12D	Instant Diary Durham U A12D	To count nos & proportions of use. Does not deal with timing of visits	"	PL/1	Fully developed	G. Ford Durham University Computer Unit

17. D2LOANS	-	Analyses loan records from Science Library at Durham. Output gives tables of books borrowed by members of different departments; also analyses length of time books have been on loan	IBM 360/67 linked with IBM 1130	PL/1	Fully developed	G. Ford Durham University Computer Unit
18. MNTHCHK	-	Counts books issued in a given month from Science Library	"	PL/1	Fully developed	"
19. LP	-	A program to perform L.P. calculations	"	MPS	Fully developed	G. Ford (user)
20. F1D	Instant Diary Durham U Nov 67 F1D	Prints a matrix showing where undergrads have come from before entering the Library and where they are going after leaving it	"	PL/1	Fully developed	G. Ford

Appendix 6

Prospectus

Introductory Note

In Chapter 3, Section III, the method of maximising the benefits from library resources was used on the Arts/Social Science Library in the University of Durham. In order to obtain the information needed to carry out the method, it was necessary to measure the resources, and in doing this a routine was evolved which could be applied to other University Libraries. This routine was codified into a Prospectus, which was sent out to some University Libraries (and see also Chapter 10). This Prospectus is reproduced in the following paragraphs of this Appendix.

To University Librarians:

CAN WE HELP YOU TO GET YOUR LIBRARY POLICY ADOPTED?

Quantitative demonstration of the likely effects of different policies might help a librarian to persuade his committee to adopt his proposals. In commercial management there are ways of calculating the numbers needed for this, but as they depend on profit estimation they are not directly applicable in a library. In order to use these modern management techniques to help in deciding what blend of services a library should offer, you need, in place of the price list used in commerce, a measure of the relative importance of the different library services.

We are developing a system to find such a measure for any library from the way it is run and used, and to do calculations based on this measure (or on a modified form allowing for changes in the situation) to produce quantitative information which can help in choosing a policy and in presenting arguments for it. The system uses the well-known technique of linear programming to do the planning calculations, and our own technique for "inversion" to find the relative importance measures.

The increasing pace of technological change makes it ever more important for the librarian to assess the impact of his policies of new items of equipment or changed ways of working. The greatest strength of any simulation technique such as ours is that it enables us to answer many questions of the form "what if ...?" in quantitative terms; thus our system can highlight the costs of new activities and their impact on existing services and resources, while allowing the librarian to use his judgment in estimating the benefits of innovation and hence the relative importance to be assigned to the new services.

We want to know whether you think the system could be useful to you after further development, so would like to try a simple version on your library to help you to form an opinion.

The trial version of the system is simplified from a model of Durham University Library: we hope it is general enough to be used for demonstrations on other libraries. We are interested in showing you what types of information can be produced by the system, not in testing the realism of the model, which is much too blunt an instrument to allow faithful representation of the activities and resources of your library. We shall describe the simple version in Durham terms, and we ask you to complete a form, at Annex A to this Appendix, giving certain basic information about your library. With this information we propose to carry out similar trials to those already done for Durham (see below.).

The simple version for Durham: "inverting" past policy

The main activities of the library staff are related by the model to the resources which constrain their planning; certain important resources, such as bookstock, do not constrain this model so are not mentioned. Once the principles of the approach are settled, it is easy to add other activities and resources and to subdivide into as much detail as required, but in explaining the system we prefer to avoid complications.

Below we list the resources and activities considered for a past 9-week period (Summer Term 1968) in Durham University Main Library, which caters for Arts and Social Science subjects. The code letters (S, I, etc.) are provided to aid cross-reference to the Tables giving full details. The following data is tabulated in full in Table 1.

Resources:

S Senior librarians had 2208 hours)
J Junior librarians had 2364 hours)
C Clerical staff had 460 hours) available
P Porters had 233 hours) to spend
There was £4315) on the
There were 83600 seat-hours) services
There were 14000 feet of empty shelves) listed

Activities, service levels and costs

I Increasing stock, measured in number of items added: in the period considered in Durham, 1530 items were added, each needing on average 72 senior minutes, 18 junior minutes, 18 clerical minutes, 2 porter minutes, 56/- and 0.1 feet of shelf space.

OILL Obtaining inter-library loans, measured in number of items: 244 items were obtained, each needing 4 senior minutes, 72 junior minutes, 12 porter minutes and 5/-.

LML Providing library materials for consultation in the library, measured in number of user-hours: 53700 hours were used, each needing 0.4 junior minutes, 0.1 porter minutes and 1 seat-hour.

LL Issuing items on long loan (2-week recall), measured in items issued: 15000 items were issued, each needing 0.6 senior minutes, 5 junior minutes and 0.1 porter minutes.

SL Issuing items on short loan (4-hour or over-night), measured in items issued: 1000 items were issued, each needing 3 junior minutes, and 1 seat-hour.

US Senior librarians giving advice to users, measured in hours: 205 hours of senior advice were given, each needing 60 senior minutes.

UJ Junior librarians helping users, measured in hours: 40 hours of junior help were given, each needing 60 junior minutes.

Derived measure of relative importance of services

The university library, in Durham as elsewhere, is run for the benefit of the academic community by librarians responsible to committees representing user interests. The policies that are followed were not derived by any quantitative planning methods: they could not have been, because of the lack of relative importance measures. We take as our starting-point in obtaining such measures the postulate that the actual policy adopted was the best way of using the given resources. We do not in fact believe - nor do most librarians - that the actual past policy was necessarily an absolute optimum in every case, but it does give us a good point of departure. Our measure of relative importance will start off as one which, if we had been planning quantitatively, would have yielded the past policy as the calculated optimum. If later we wish to argue that the measures for future application should be different from that derived from past policy, we are entitled to do so - it may be that the model itself, or the information fed into it, was not realistic enough, or it may be that conditions have changed - but we will need to provide some reasoned arguments for upsetting the derived measures.

Thus we look first at the actual service levels in Durham in the period considered, stated above, supposing that they were decided by a quantitative planning technique. Operation of the library services at these levels means that the library administration behaved as if:

1 item of new stock was worth the same as
4.6 items on inter-library loan, or
1300 user reference hours, or
90 items on long loan, or
200 items on short loan, or
3.3 hours of senior advice, or
9.1 hours of junior advice.

We have expressed the relative importance of each service in terms of the amount of it that would be of equivalent importance to the addition of 1 item to the bookstock, since we think this is likely to be the easiest for a library committee to understand. An economist would prefer to express these relative importance ratios as prices, so that the highest number would refer to the most important unit of service rather than, as here, the least important.

The relative importance ratios (e.g. 1 item of increased stock is 1300 times as important as 1 user reference hour) were derived by our "inversion" method: if the given costs are resources and this list of importance ratios had been fed into a linear programming calculation, the output would have been a recommendation to adopt the service levels quoted above.

The simple version for Durham: planning ahead

Next we show the sort of planning information that can be produced once we have a measure of the relative importance of the different services. Note again that we are not tied to using the measure derived from the past policy - we can modify it as we wish to take account of changed circumstances or just because it "seems wrong".

There is no difficulty in doing a set of calculations with different importance measures to see how the suggested policy changes as the measures alter, though in many cases we can say without needing to do any further calculation that the resulting policy will not be changed (see Appendix 1 for a geometrical illustration).

In Table 2 we consider a future 9-week period in which all costs, resources and importance ratios are exactly the same as in Table 1. We have to make some sort of assumption about demand levels, and we have chosen here to assume that the three services which the librarians cannot control except by changes in borrowing regulations or opening hours (reference use, long loans and short loans) will have to be set at least at the levels given in Table 1. We could have allowed for an increase in demand or for changed rules if we had wished. The "demand constraints" which result are set out in 2D.

The recommended service levels shown in 2E are automatically the same as those in Table 1C, because the data for the calculations is the same. Some important extra information is produced, telling us what resources are not used and what resources could most usefully be increased. In 2F, we see that 1 clerical hour is unused, as well as a lot of seat-hours and shelf-feet. In 2G it is shown that if we could add 1 senior hour we could gain benefit corresponding in importance to the addition of 0.3 books added to stock, if we could add 1 junior hour we would gain 0.1 book-equivalents, if we could add 1 porter hour we could gain 0.07 book-equivalents and if we could add £1 we would gain 0.22 book-equivalents. Adding extra clerical labour would gain nothing, as we had 1 hour to spare.

These figures are significant management information when we compare the costs of providing these extra resources: £1 spent on senior labour at 24/- per hour or on junior labour at 8/- per hour would gain 0.25 book-equivalents, rather more than we would gain by adding £1 to the book-buying budget. When we say we would gain 0.25 book-equivalents per £ spent on skilled labour, we do not mean that £4 spent in this way would mean that one more book was bought, but that if we did spend £4 in this way all the service levels would be readjusted to allow best use of the new resources, and the total extra services would be equivalent in importance to one extra book.

In Table 3 we examine the effect of a change in the relative importance ratios; the increase of book-stock has been given a rather higher importance than before in relation to all the other services, their ratios one to another remaining as before. No dramatic changes in service levels result, only the amount of reference use changing so that it leaves its constrained minimum level. This means in practice not that user demand would actually reach this level, but rather that it would be worthwhile for the librarians to provide for and encourage more reference use on this scale, to allow the best balance of services with the given resources and costs.

The most significant change as compared to Table 2 is that clerical labour is now used up, and becomes the resource most worth increasing - the worst bottleneck. Though £1 spent on increasing senior or junior labour would yield 0.25 book-equivalents, as before, we now find that £1 spent on extra clerical labour (costing 8/- per hour) would yield 1 book-equivalent - four times as much. Putting it another way: if we got into this situation, it would be worth paying more for extra clerical labour than for extra senior librarians!

In Table 4 we keep the same costs and relative importance ratios as in Table 3, but increase the book budget by 10%, leaving other resources as they were. We are unable to spend the extra money because of the clerical bottleneck: a little gets spent on obtaining more inter-library loans, but £422 is wasted! We find that extra clerical labour becomes extremely valuable, so that £1 spent this way would yield more than 5 book-equivalents, twenty times as much as £1 spent on librarians. Porters, too, become an important bottleneck, extra porters being three times as valuable as extra librarians when we are in this unbalanced situation.

The moral, of course, is that the library committee should relax its inflexible rule and allow the librarian to spend some of his book-budget on extra clerical and portering staff.

Other calculations

We have performed a great many other calculations with different circumstances, such as increased book-prices, more efficient junior librarians, more staff, etc., but we feel that the results given suffice to show the power of the system.

If there are any particular changes in circumstances which interest you (particular productivity increases, new staff, relaxation of barriers between budgets, increase in importance of one service relative to others, etc.), please let us know when returning the form, and we will try to do computer runs with appropriate conditions.

Table 1

INVERSION OF PAST POLICY TO FIND IMPLICIT RELATIVE IMPORTANCE

TABLE 1		DURHAM UNIVERSITY MAIN LIBRARY Summer Term 1968							9 weeks	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B TOTAL RESOURCE AVAILABLE	
SERVICE:		I	OILL	LML	LL	SL	US	UJ		
UNIT:		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2208x60	S
	J	18	72	0.4	5	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4315x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		SERVICE LEVELS (ACTUAL)								
		1530 items I	244 items OILL	53700 hours LML	15000 items LL	1000 items SL	205 hours US	40 hours UJ		
D		RELATIVE IMPORTANCE (DEDUCED)								
		1 item= I	4.6 items= OILL	1300 hours= LML	90 items= LL	200 items= SL	3.3 hours= US	9.1 hours UJ		

Table 2

PLANNING OF FUTURE POLICY Costs, resources and relative importance as Table 1

TABLE 2		DURHAM UNIVERSITY MAIN LIBRARY Run 18F							9 WEEKS	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B TOTAL RESOURCE AVAILABLE	
SERVICE:		I	OILL	LML	LL	SL	US	UJ		
UNIT:		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2208x60	S
	J	18	72	0.4	5	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4315x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		RELATIVE IMPORTANCE as 1D								
		1 = item I	4.6 = items OILL	1300 = hours LML	90 = items LL	200 = items SL	3.3 = hours US	9.1 hours UJ		
D		DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
		* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
		The above data yield the following results								
E		RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								
		1530 items I	244 items OILL	53700* hours LML	15000* items LL	1000* items SL	205 hours US	40 hours UJ		

PLANNING OF FUTURE POLICY Costs, resources and relative importance as Table 1

TABLE 2	DURHAM UNIVERSITY MAIN LIBRARY Run 18F							9 WEEKS	
A	AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B TOTAL RESOURCE AVAILABLE	
SERVICE:	I	OILL	LML	LL	SL	US	UJ		
UNIT:	item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES S	72	4	0	0.6	0	60	0	2208x60	S
J	18	72	0.4	5	3	0	60	2364x60	J
C	18	0	0	0	0	0	0	460x60	C
P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS	56	5	0	0	0	0	0	4315x20	
SEAT-HOURS	0	0	1	0	1	0	0	83600	
SHELF-FEET	0.1	0	0	0	0	0	0	14000	
C	RELATIVE IMPORTANCE as 1D								
	1 = item I	4.6 = items OILL	1300 = hours LML	90 = items LL	200 = items SL	3.3 = hours US	9.1 hours UJ		
D	DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
	* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
	The above data yield the following results								
E	RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								
	1530 items I	244 items OILL	53700* hours LML	15000* items LL	1000* items SL	205 hours US	40 hours UJ		
F	RESOURCES NOT USED								
	0 hours S	0 hours J	1 hours C	0 hours P	0 £	28900 seat-hours	13847 shelf-feet		
G	BENEFIT TO BE GAINED BY ADDING RESOURCES (No. of items of I gained per unit addition)								
Item of I per	0.3 hour S	0.1 hour J	0 hour C	0.07 hour P	0.22 £	0 seat-hour	0 shelf-foot		

Table 3

PLANNING OF FUTURE POLICY Changing the relative importance ratios

TABLE 3		DURHAM UNIVERSITY MAIN LIBRARY Run 15M							9 WEEKS	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B TOTAL RESOURCE AVAILABLE	
SERVICE		I	OILL	LML	LL	SL	US	UJ		
UNIT		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2208x60	S
	J	18	72	0.4	0	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4315x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		RELATIVE IMPORTANCE								
		1 = item I	5 = items OILL	1400 = hours LML	100 = items LL	224 = items SL	3.7 = hours US	10.2 hours UJ		
D		DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
		* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
		The above data yield the following results								
E		RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								

Table 3

PLANNING OF FUTURE POLICY Changing the relative importance ratios

TABLE 3		DURHAM UNIVERSITY MAIN LIBRARY Run 15M							9 WEEKS	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B	
SERVICE		I	OILL	LML	LL	SL	US	UJ	TOTAL RESOURCE AVAILABLE	
UNIT		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2208x60	S
	J	18	72	0.4	5	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4315x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		RELATIVE IMPORTANCE								
		1 = item I	5 = items OILL	1400 = hours LML	100 = items LL	224 = items SL	3.7 = hours US	10.2 hours UJ		
D		DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
		* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
		The above data yield the following results								
E		RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								
		1533 items I	209 items OILL	57567 hours LML	15000* items LL	1000* items SL	179 hours US	37 hours UJ		
F		RESOURCES NOT USED								
		0 hours S	0 hours J	0 hours C	0 hours P	0 £	25033 seat-hours	13846 shelf-feet		
G		BENEFIT TO BE GAINED BY ADDING RESOURCES (No. of items of I gained per unit addition)								
Item of I per:		0.3 hour S	0.1 hour J	0.4 hour C	0.07 hour P	0.2 £	0 seat-hour	0 shelf-foot		

Table 4

PLANNING OF FUTURE POLICY As 3 except higher budget

TABLE 4		DURHAM UNIVERSITY MAIN LIBRARY Run 15T							9 WEEKS	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B	
SERVICE		I	OILL	LML	LL	SL	US	UJ	TOTAL RESOURCE AVAILABLE	
UNIT		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2200x60	S
	J	18	72	0.4	5	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4747x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		RELATIVE IMPORTANCE as 3C								
		1 item I	= 5.0 items OILL	= 1400 hours LML	= 100 items LL	= 224 items SL	= 3.7 hours US	= 10.2 hours UJ		
D		DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
		* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
		The above data yield the following results								
E		RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								

TABLE 4		DURHAM UNIVERSITY MAIN LIBRARY Run 15T							9 WEEKS	
A		AMOUNT OF RESOURCE NEEDED PER UNIT OF SERVICE							B	
SERVICE		I	OILL	LML	LL	SL	US	UJ	TOTAL RESOURCE AVAILABLE	
UNIT		item	item	hour	item	item	hour	hour		
LABOUR IN MAN-MINUTES	S	72	4	0	0.6	0	60	0	2208x60	S
	J	18	72	0.4	5	3	0	60	2364x60	J
	C	18	0	0	0	0	0	0	460x60	C
	P	2	12	0.1	0.1	0	0	0	233x60	P
MONEY IN SHILLINGS		56	5	0	0	0	0	0	4747x20	
SEAT-HOURS		0	0	1	0	1	0	0	83600	
SHELF-FEET		0.1	0	0	0	0	0	0	14000	
C		RELATIVE IMPORTANCE as 3C								
		1 item I =	5.0 items OILL =	1400 hours LML =	100 items LL =	224 items SL =	3.7 hours US =	10.2 hours UJ		
D		DEMAND CONSTRAINTS (SERVICE LEVELS MUST BE NO LESS) (* = no constraint on this service)								
		* item	* items	53700 hours	15000 items	1000 items	* hours	* hours		
		The above data yield the following results								
E		RECOMMENDED SERVICE LEVELS RESULTING (* = constrained level)								
		1533 items I	248 items OILL	53700* hours LML	15000* items LL	1000* items SL	177 hours US	14 hours UJ		
F		RESOURCES NOT USED								
		0 hours S	0 hours J	0 hours C	0 hours P	422 £	28900 seat-hours	13847 shelf-feet		
G		BENEFIT TO BE GAINED BY ADDING RESOURCES (No. of items of I gained per unit addition)								
Item of I per:		0.3 hour S	0.1 hour J	2.1 hour C	0.3 hour P	0 £	0 seat-hour	0 shelf-foot		

Annex A to Appendix 6

BEFORE COMPLETING EACH SECTION OF THIS FORM, PLEASE READ THE RELEVANT EXPLANATORY NOTES WHICH FOLLOW (Annex B).

FACTS AND FIGURES: ____________ LIBRARY

1. TIME PERIOD

Please fill in dates:

Year 1967/68: From ________ To ________

Summer Term 1968: From ________ To ________

2. STAFF

Number in each grade:	Senior Librarians	....
	Junior Librarians	....
	Clerical Staff	....
	Porters	....

3. WORKING WEEK

Number of hours in a working week:	Senior Librarians	....
	Junior Librarians	....
	Clerical Staff	....
	Porters	....

4. FUNDS

Money available for purchasing books in 1967/68 £........

Money actually spent on purchasing books in 1967/68 £........

5. SEATS

Number of seats available in the library ....

6. SHELVES

Number of feet of shelving available for additions to stock ....

Date on which this estimate was made ....

7. ACQUISITIONS

Number of books added to stock during 1967/68 ....

7. ACQUISITIONS (continued)

Number of books added to stock during Summer term 1968 ....

8. INTER-LIBRARY LOANS

Number of items obtained on inter-library loan during 1967/68 ....

Number of items obtained on inter-library loan during Summer term 1968 ....

9. LOANS

Number of "long loans" made during 1967/68 ....

Number of "long loans" made during Summer term 1968 ....

Number of "short loans" made during 1967/68 ....

Number of "short loans" made during Summer term 1968 ....

Can books on "short loan" be taken out of the library? ....

10. READERS

How many people entered the library during 1967/68? ....

How many people entered the library during Summer term 1968? ....

Other data on readers

11. OPENING HOURS

	Allocation of Staff Duties	Senior	Junior	Clerical	Porters
12.	Acquisitions				
13.	Cataloguing				
14.	Circulation				
15.	Reference Services				
16.	Inter-library loans				
17.	Periodicals, Government Publications and Binding				
18.	Photocopying Service				
19.	Administrative & Committee Work				
20.	Security, Cloakroom Supervision				
21.	Other				

22. **Other Data**

How many volumes were bound in 1967/68? ....

How many periodicals did you subscribe to in 1967/68? ....

How many items did you lend to other libraries in 1967/68? ....

Annex B

NOTES ON HOW TO COMPLETE THE PRO FORMA (Annex A)

Most of the data required for the calculations is already available within individual institutions, and some of it is printed in Annual Reports, although not necessarily in a standardised form. The numbered paragraphs below correspond to the sections in the pro forma (Annex A). Please specify at the top the name of your library: this should be the main library of the university. This will be for internal use only, and not for publication.

1. Time Period

Most statistics are compiled on an annual basis, but some libraries also collect data relating to particular terms. Our original calculations were based on data for the Summer term, 1968, and if possible we should like data for the same period for your library. However, the data for the year 1967/68 would be equally acceptable. University financial years often run from August 1st to July 31st and statistics are usually compiled for the same period. In sections 7, 8, 9 and 10 only one set of figures need be entered.

2. Staff

We define the 4 grades of staff as follows:

Senior:	graduate staff, and non-graduate professionally qualified staff. Normally referred to as Assistant Librarians, Senior Library Assistants and Sub-Librarians; also includes the Librarian, and Deputy. Includes graduate trainees if they are doing "senior" work.
Junior:	non-graduate, non-professionally qualified. The Library Assistant, in fact. Includes graduate trainees if they are doing "junior" work. There is no harm in counting graduate trainees as being ½ in each grade, if this describes their duties.
Clerical:	secretaries, typists, accounts clerks; also Xerox operators. Photographic technicians are excluded from this scheme: if their duties include Xerography, a suitable fraction should be counted
Porters:	the "industrial" grade; normally employed on security, parcel packing and opening, cloakroom supervision, book hoisting; sometimes on shelving books also.

Throughout, part-time staff should be counted as suitable fractions.

3. Working Week

This is usually 37½ hours, excluding lunch hours but including tea/coffee breaks. Porters usually work a 42-hour week. No allowance need be made for sick leave and holidays.

4. Funds

This section relates to the money available for purchasing books (monographs), and does not include that spent on periodicals, government publications, etc.

5. Seats

This is self-explanatory.

6. Shelves

We do not expect this figure to be accurate to the last inch! We are concerned with the amount of shelving available for new books. As this is not normally a figure which is calculated every week, we would like the latest estimate you have, with an indication of when this estimate was made.

7. Acquisitions

Here we would like to know the number of books (monographs) added to stock during the relevant period.

8. Inter-library loans

This is self-explanatory.

9. Loans

"Short loans" we define as books which are restricted in certain ways: they are kept as a closed access collection, or on open access with a separate control point. They are usually borrowable for a few hours at a time, or overnight, and frequently are restricted to use in the library. "Long loans" are those books lent in the normal way.

10. Readers

Some libraries have turnstiles recording the number of people entering the library each day. Others carry out occasional spot checks. You may have carried out a survey recently which yields data on the amount of use of the library. For example, in the Summer term, we would expect more than half of the readers to be working entirely with their own materials in the library, and to spend, on average, about 1½ hours in it at a time. You may have information confirming or refuting these suggestions.

11. Opening Hours

We should like a specification of the opening hours for the entire year 1967/68

e.g.	Term time	Vacation
Mon-Fri	9 a.m.-10 p.m.	9 a.m.-5 p.m.
Saturday	9 a.m.-5 p.m.	9 a.m.-5 p.m.
Sunday	2 p.m.-8 p.m.	-

12-21 Allocation of Staff Duties

We have itemised a number of traditional headings under which staff are employed. Because libraries tend to work on a daily cycle, we are asking how many hours of each staff grade are available for the tasks on each day. Thus a full-time cataloguer would spend 7 hours on cataloguing. Junior assistants might each spend 1 hour on processing books (Acquisitions) and 6 hours shelving books and on the issue desk (Circulation).

12. Acquisitions

This includes all such tasks as book selection, ordering, invoice checking, accessioning, unpacking parcels, processing.

13. Cataloguing

This includes "cat. & class", catalogue typing, catalogue reproduction, filing of entries.

14. Circulation

This includes issuing books for loan, receiving books returned from loan, reservations and recalls, filing of issue records, shelving books, clearing books from tables.

15. Reference services

This refers only to library staff specifically allocated to this duty: the task is usually combined with something else.

16. Inter-library loans

All the procedures involved in this branch: both for outgoing loans and incoming ones.

17. Periodicals, Government Publications, Binding

This will include receipt and processing, binding preparation, perhaps invoice checking.

18. Photocopying Service

Self-explanatory.

19. Administration and Committee Work

Usually the prerogative of the Librarian and Deputy and their secretaries!

20. Security, Cloakroom Supervision

Usually the porter grade.

21. Other

Finally, a few statistics which will normally appear in your Annual Report.

Thank you for your help. You will notice that we ask for information on some library activities which are not mentioned in the tables of results accompanying this form. We need the data, however, in order to make adjustments to the total staff-time available within the library so that we do not get an apparent waste of resources.

Appendix 7

Conversion of Proforma Data for Computer Input

Throughout this section, the abbreviations I, LML, S, P, etc. are used to refer to the activities, resources and constraints listed in Chapter 3, section III, and in Appendix 6. The phrase "item n" refers to the correspondingly numbered sections in Annex A to Appendix 6 (the pro forma).

The information contained in the completed pro forma can be used, with some assumptions, to set up the linear programming calculations.

1. Activities

The activity levels depend on the time period over which they are measured. Figures are usually available which cover the whole financial or academic year, and some are also calculated for each term. For those items which are not normally counted on a termly basis (e.g. additions to stock), an appropriate fraction can be taken if so desired, according to the following.

$$\frac{\text{No. of weeks in term}}{46} \times \text{activity level for whole year}$$

(The working year is usually 46 weeks, and full staffing is normal during term-time.)

I see item 7.

OILL see item 8. There is often a fluctuation in demand for inter-library loans over the year. This may become apparent through a surplus of labour at periods of low-demand (assuming that the staff can cope at periods of high demand): or it may be that demand fluctuations are smoothed out because the labour force uses the "surplus" time for compiling statistics, chasing borrowed items due for return, investigating less urgent difficulties which have arisen, etc. Experience suggests that this smoothing does in fact occur.

LML calculation based on item 10. The extent of this kind of use of the library can of course be obtained by survey, but some reasonable estimates can be made. Thus for the summer term, the level would be

$$\tfrac{1}{2} \times \text{number of people entering library} \times 1\tfrac{1}{2} \text{ hours}$$

For the remaining two terms, a reasonable estimate would be

$$2/3 \times \text{number of people entering library} \times 1\tfrac{1}{2} \text{ hours}$$

During the vacations the pattern of use is rather different to that of term-time. The estimate would be

Number of people entering the library x 2/3 hours

These estimation formulae are tentative, particularly the last, but do provide a basis. It is probable that the last two formulae will err on the low side.

LL see item 9.

SL see item 9. Not all libraries operate a short loan collection; others have a supervised reading room with books, on open access, which may not be removed for outside use. In the simple model, this activity would be excluded unless data on its use were available.

US }
UJ } not usually measured. One way of counting these activities is by counting the resources devoted to them (cf. Chapter 2). Another way is to assume that undergraduates will make brief consultations of the junior library staff, and academic staff will make less brief consultations of the senior library staff. Surveys suggest that these consultations will be less than 1 minute (brief) and around 10 minutes (less brief) in duration.

It is a comparatively easy task to make a count over a given period of the number of consultations of one sort or another; it is likely that 10% of all users make brief consultations on a typical day, but much will depend on the demeanour of the library staff, and the clarity of guides to the library stock.

2. Resources

S }
J }
C }
P } see items 1, 2 and 3. The number in each staff grade (item 2) is multiplied by the corresponding working week (item 3), and the product is multiplied by the length of the period under consideration (item 1). If the calculations are for the whole year, it is assumed that there are 46 weeks in the working year. Deductions are then made for the activities which are not considered in the simple model. These are items 17-21, and part of item 16. In each of the items 17-21, the figures should be multiplied by 252 (number of working days in a year) before deduction from the total. Item 16 (Inter-library loan) includes time spent on obtaining and providing loans. If it is assumed that the time spent on obtaining one item is the same as the time spent on providing one item, then the relevant fraction to be

deducted from the total resources will be

$$\frac{\text{item 22(loans to other libraries)}}{\text{item 8 + item 22}} \times \text{time spent on ILL} \times \text{253 hours}$$

Items 17-21 provide a check on the total resources. Thus, for each grade of staff, the total number of hours devoted to the various activities x 253 must not be greater than the total resource calculated from items 1, 2 and 3.

Budget see item 4. The resource is the money available for purchasing books (in most libraries this is the same as the money actually spent).

Seats see items 5 and 11. The resource is the total number of seats multiplied by the number of hours for which the library is open during the time period under review.

Shelves see item 6. The date on which the estimate was made affects this figure. To obtain a figure for the amount of shelving now available, take the number of volumes added to stock since the estimate was made, multiply by 8, and deduct the product from the estimated total to get the present total resource. This figure should then be divided by the number of years which are expected to elapse before a new library building is expected, and the resulting figure will be the shelving "allowance" for the coming year.

3. Demand constraints

DLML }
DLL } these are numerically the same as the activity levels for LML, LL and SL
DSL } respectively.

4. Technical coefficients

There are three methods of getting the figures for the technology matrix. One is by using data collected by other libraries; another is to discover, by activity sampling, work measurement, etc., how long is spent on each task, and to build up the matrix from first principles. The third way is to take the total amount of time devoted to an activity and divide by the amount produced. A combination of all three methods is usually necessary.

I Labour

This activity includes acquisitions and cataloguing (items 12 and 13) and also part of the shelving time included in item 14. Shelving time is covered more fully under

LL (below): it will suffice here to indicate that some shelving time is included here. Because it is difficult to measure the time taken to order one book, or to catalogue one item, the method here is to take the total time devoted to each operation and divide this by the number of items added to stock.

Budget

The amount of money spent on books (item 4) divided by the number of books added to stock (item 7) yields the technical coefficient. This figure will be less than the average price of books purchased, because it takes into account books given to the library (which have effectively a zero price). As these gifts require as much labour as a purchased book, this is realistic. The assumption is that the proportion of gifts catalogued to purchases catalogued remains fairly constant. Another assumption is that the period between the purchase of a book and its cataloguing is less than the period for which the linear programming calculations are performed. It would be possible to use lagged variables in the calculation, but this is an unnecessary complication in the 3-month calculation: if the cataloguing backlog is a year or more, the library is probably inefficient and the method will be invalid.

Shelves

Measurements in Durham and Newcastle confirm the oft-quoted figure of "8 books per linear foot".

OILL Much the same procedure is followed here as for I. The time spent on obtaining inter-library loans is divided by the number obtained (item 8). The amount of time spent on obtaining loans has been discussed under Resources (above).

LML The only labour used here is that required to re-shelve books after their use within the library. It is not difficult to organise a special one-week check on this and to extrapolate for the whole time period. The number of books used is probably approximately the same as the number of visits made to the library; perhaps one-third of these books will be shelved by the users themselves.

LL The labour requirements here are made of several components. Good estimates can be made of the time required to issue books, to discharge them on return, etc. Shelving time is also taken into account. It can be assumed that one loan results in one reshelving. Because shelving is usually done in one fell swoop, including books returned from loan, books added to stock and books found on the tables, it can be assumed that the average time taken to shelve a book is constant whatever its immediate provenance. So a special one-week check on time spent shelving, and number of books shelved will suffice for the 3 activities I, LML and LL.

SL Frequently short loan collections are administered separately from the main loan stock, but estimates of labour requirements can be made in the same way as for LL.

US} UJ} As explained in Chapter 2, one hour devoted to assisting readers is presumed to result in one hour of service to users.

Appendix 8

Surveys of Unrecorded Use (M1D, M1N, M2D)

Surveys of unrecorded use were carried out on 6th May, 1968, in the University Libraries at Durham and Newcastle upon Tyne. Three libraries were surveyed simultaneously: at Durham, the Main Library (Arts & Social Sciences) (M1D) and the Science Library (M2D), at Newcastle, the University Library (M1N).

Purpose

The number of books borrowed from a library is frequently the only known fact about the use made of that library: sometimes a count is available of the number of persons entering or leaving. It is desirable to know what use is made of library materials within the library, although this is difficult to measure within an open-access system. These three parallel surveys were intended to yield more information on this aspect.

Method

The surveys were intended to discover the extent of non-use as well as of use. This eliminated the method used in Chicago (Fussler & Simon, 1961). The only practical method was to use a simple questionnaire: the briefest possible in view of the fact that examinations were only three weeks away, so apart from identification details, only two questions were asked. The "Instant Diary" type of PEBUL surveys (see Chapter 6) was used: each person entering the library was given a card (see Chapter 6 Annex 5) stamped with the time of entry; the cards were again stamped when returned to the survey staff on the user's exit from the library.

In addition, a list was made of all the books borrowed at the two Durham libraries on that day; and at the Science Library only, users were requested to leave books on the reading tables after using them. These were also listed.

Administration and Costing

A number of students were employed at both universities to carry out the survey and the project staff kept a general eye on the scene and provided reliefs for coffee breaks, etc.

The libraries were open from 9 a.m. to 10 p.m. The student labour cost £12, and the actual survey cards worked out at about ½d. each (about 6000 were produced, by duplication onto blank postcards).

Results

A vast amount of information is yielded by even such a simple survey as this. The more important tabulations are presented here, with indications of some of the other possibilities. Some comparisons are made with earlier surveys.

934 cards were completed at Durham Arts/Social Sciences Library, 615 at Durham Science Library, and 2767 at Newcastle.

1. Numbers of respondents by status

(a) By Universities

	Under grads	Post grads	Staff & Research	Others	Total
Newcastle					
Total no. of visitors	2266	106	236	159	2767
No. of visitors	1142	68	184	124	1518
No. of items used in library	1867	101	659	226	2853
Durham					
Total no. of visitors	1251	31	181	86	1549
No. of visitors	732	26	129	66	953
No. of items used in library	1290	23	363	130	1806

(b) Durham University - split by libraries

Durham (Arts/SS)					
Total no. of visitors	786	21	73	54	934
No. of visitors	443	16	56	42	557
No. of items used in library	852	9	150	91	1102
Durham (Science)					
Total no. of visitors	465	10	108	32	615
No. of visitors	289	10	73	24	396
No. of items used in library	438	14	213	39	704

2. Time spent in libraries

Average time per visit (in minutes)

	Under grads	Grad Course Students	Research Students	Academic Staff	Others
May 1968					
Durham Arts/SS	106	101	72		59
Durham Science	101	85	42		45
Newcastle	100	69	46		72
Nov 1966					
Durham Arts/SS (A1D)	63	65			46
Durham Science (A2D)	68	33			37
Feb 1968 (K1N)					
Newcastle	85	77	61	41	83

3. Use of Library Materials

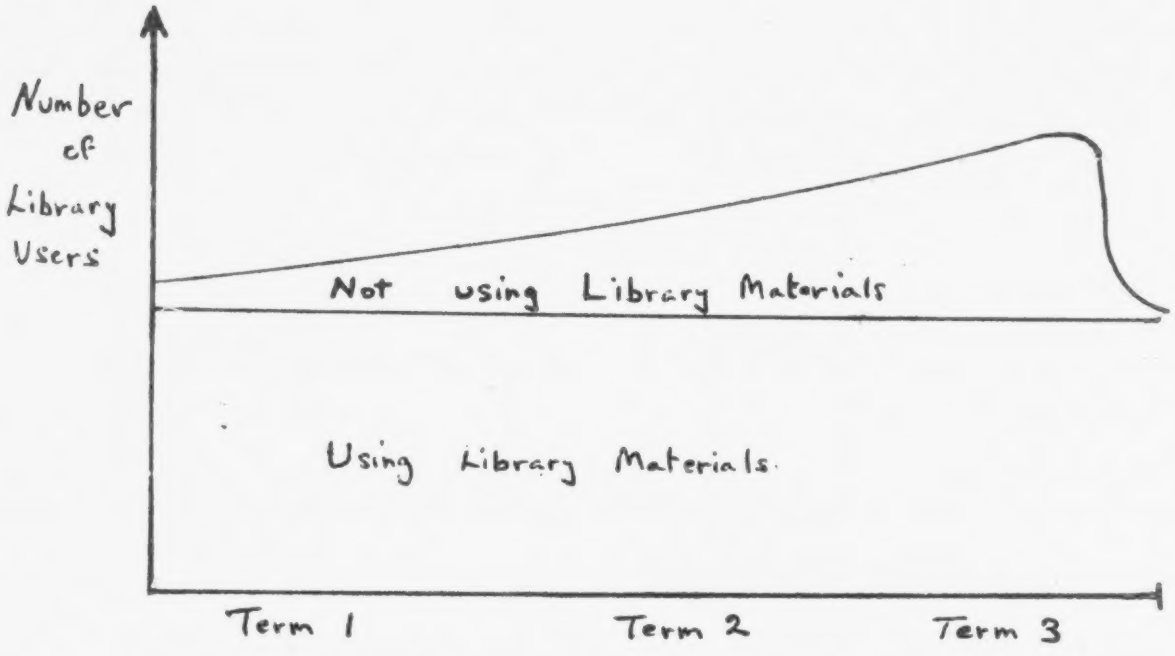
(a) Percentage of "Users" not using Library Material

	Under grads	Grad Course Students	Academic Staff & Research Students	Others
May 1968				
Durham Arts/SS	55.7	76.2*	27.4	23.0
Durham Science	53.8	20.0*	35.2	44.5**
Newcastle	62.7	60.4	25.8	41.1

(* - sample too small to be significant - see Table 1; if the two samples are combined, the figure is 60%)

(** - sample too small to be significant - see Table 1)

May is the time of maximum use of the university library. Undergraduates use it very heavily, but more often than not only as a place to read their books and notes. In fact, there seems to be a fairly stable level of "normal" use throughout the three terms of the university year - undergraduates, research students and academic staff using the library stock, and borrowing books in a fairly regular pattern. There is, in addition, particularly in the Summer term, a large body of students who do not use the library stock. The proportion gradually increases throughout the year. Graphically:



Surveys carried out in Durham more recently confirm this pattern. Thus in March, 1969, 36% of undergraduates using the Arts/Social Sciences Library did not use library materials. In May, 1969, the figure was 49%*.

(b) Book borrowing and consultation

	Books borrowed	Books consulted	Books left on tables
Durham Arts/SS	272	1102	-
Durham Science	87	704	301

The ratio Books consulted:Books borrowed has been variously reported from other libraries as between 3:1 and 11:1. In Durham it appears to be between 4.05:1 (Arts/Social Sciences) and 8.08:1 (Science). There are, however, wide variations between subjects: 34:1 for Psychology undergraduates, 1:1 for Philosophy undergraduates. A more stable figure seems to be Books consulted:Number of visits.

* In October 1968, a new duplicate collection of heavily used textbooks was brought into use, helping to satisfy previously unsatisfied demands. This may explain the decrease from 56%, as the undergraduates can now find books to use.

(c) Visits & Consultations: ratio $\frac{\text{No. of consultations}}{\text{No. of visits}}$

	Undergrads	All Users
Durham Arts/SS	1.08	1.17
Durham Science	0.94	1.14
Newcastle	0.82	1.02
Lancaster 1968	-	1.03

(d) Visits, Consultations & Borrowings: Undergrads

Differences are to be expected between the two universities, particularly among the science subjects; in Newcastle, departmental libraries in the sciences and applied sciences are of more importance than they are in Durham. Also the scope of the subjects varies. Engineering Science (in Durham) is not comparable with Mechanical Engineering, Chemical Engineering, etc. in Newcastle. The overall picture, however, remains notably consistent. (See table overleaf)

A8.6

B = No. of books borrowed
C = No. of books consulted
V = No. of visits

	Durham			Newcastle	
	V	C/B	C/V	C/V	V
Subject					
Philosophy	4	1.00	1.25	1.50	11
Psychology	64	33.75	2.11	1.67	8
Theology	24	1.08	1.08	0.67	12
Sociology	45	2.36	0.36	0.50	29
Politics	21	4.00	0.76	-	-
Economics	41	2.93	1.06	0.68	99
Law	10	6.25	1.19	1.39	87
Education	31	4.00	1.03	-	-
English	63	1.62	1.15	1.24	136
German	7	10.00	1.43	1.57	80
French	23	1.10	0.96	1.78	36
Spanish	10	5.00	1.00	-	-
Russian	3	2.00	0.67	-	-
Classics	21	3.50	1.00	1.15	75
Music	32	2.85	1.16	-	-
History	101	2.18	0.93	1.48	85
Geography	132	85.00	1.28	1.25	124
Engineering	13	22.00	1.69	**0.20	528
Zoology	42	4.00	0.76	0.21	58
Botany	30	7.63	2.03	0.78	34
Geology	11	14.00	1.27	1.50	16
Chemistry	72	13.00	0.54	0.57	79
Physics	27	3.33	0.48	0.00	26
Mathematics	42	2.00	0.28	0.88	37
Anthropology	19	*	1.26	-	-

* All books confined to the library.
** Average of 8 departments

The calculations made here rest on two major assumptions.

(1) Undergraduates studying a particular discipline borrow books which are classified as if they related that discipline; i.e., students of Physics borrow books from Dewey class 530. This assumption is based on a pilot study of the books borrowed by undergraduates at Newcastle in late 1967, which showed that not more than 10% of the books borrowed by students were outside the "expected" fields as defined by Dewey class numbers.

(2) The books consulted reflect the same pattern as the above.

A more recent survey in Durham, in March 1969, was concerned with evening use of the Arts/Social Sciences Library. Conditions are not strictly comparable with the May 1968 survey, as a special collection of duplicates of heavily used textbooks had been introduced. But the following facts are given, concerning use of the library after 6 p.m.

	Day time May 1968	Evening March 1969	
% of users using library materials (U)	44	64	
No. of items used per visit made to library (C)	1.22	1.89 1.69	(inc. use of duplicates) (not inc. use of duplicates)
$\frac{C}{U} \times 100$	2.77	2.96 2.64	} mean = 2.80

The agreement in the last row is close enough to suggest a formula: 100 persons visiting the library for reasons other than as a place to work will use about 280 items of library stock.

4. Use of library materials compared with time spent in library

There is no overall link between the number of items used and the length of time spent in the library. The modal time spent in the library is between 1 and 2 hours at both Durham and Newcastle, consistent with the mean time at both places; and the frequency distribution of time spent in the library is independent of the number of items used. Some examples are given in figs. 1 and 2.

Similarly, both the length of the visit, and the number of items used are independent of the year of study (for undergraduates). However, the number of items used does seem to be dependent in some fashion on the status of the user. Examples are given in figures 3, 4 and 5.

5. Use and potential use

	No. of undergrads in university(T)	No. of undergrad visits to library(V)	$\left(V/T\right)$ x 100%
Durham	ca 2550	ca 1250	49%
Newcastle	ca 4560	ca 2270	50%

At Durham, 732 undergraduates made 1.71 visits each. At Newcastle, 1142 undergraduates made 1.98 visits each.

6. Age of materials used: Durham Science Library

The data collected from the books left on the reading tables in the Science Library comprised the date of publication, date of acquisition and class number. The sample comprised 134 monographs, 153 periodicals, 10 abstracting journals and 4 others. The age distribution of the monographs can be compared with data collected in the same library in November 1967.

Age in Years	Books in stock 1967 %	Books used 1968 %	Books returned from loan 1967 %
≤ 5	29	33	36
6-10	15	28	20
11-15	19	11	16
16-20	11	7	11
21-25	3	3	3
26-30	2	4	0
31-40	13	4	11
41-50	2	4	3
> 50	8	3	0
Average age in years	17	14	11
No. in sample	not known	134	138

(all figures rounded)

The overall picture shows what one would expect - the users select the more recent material. The sample is too small to make any statements about particular subjects.

Notes on the data

The survey was carried out on a Monday, just over 3 weeks before the university examinations began. Library use in Durham was near to its peak - the number of visits to the Arts/Social Sciences Library being 85% of the maximum number recorded in that term.

During the surveys, major visits only were recorded; users who slipped out for a smoke or a coffee were not asked to complete new forms.

Conclusion

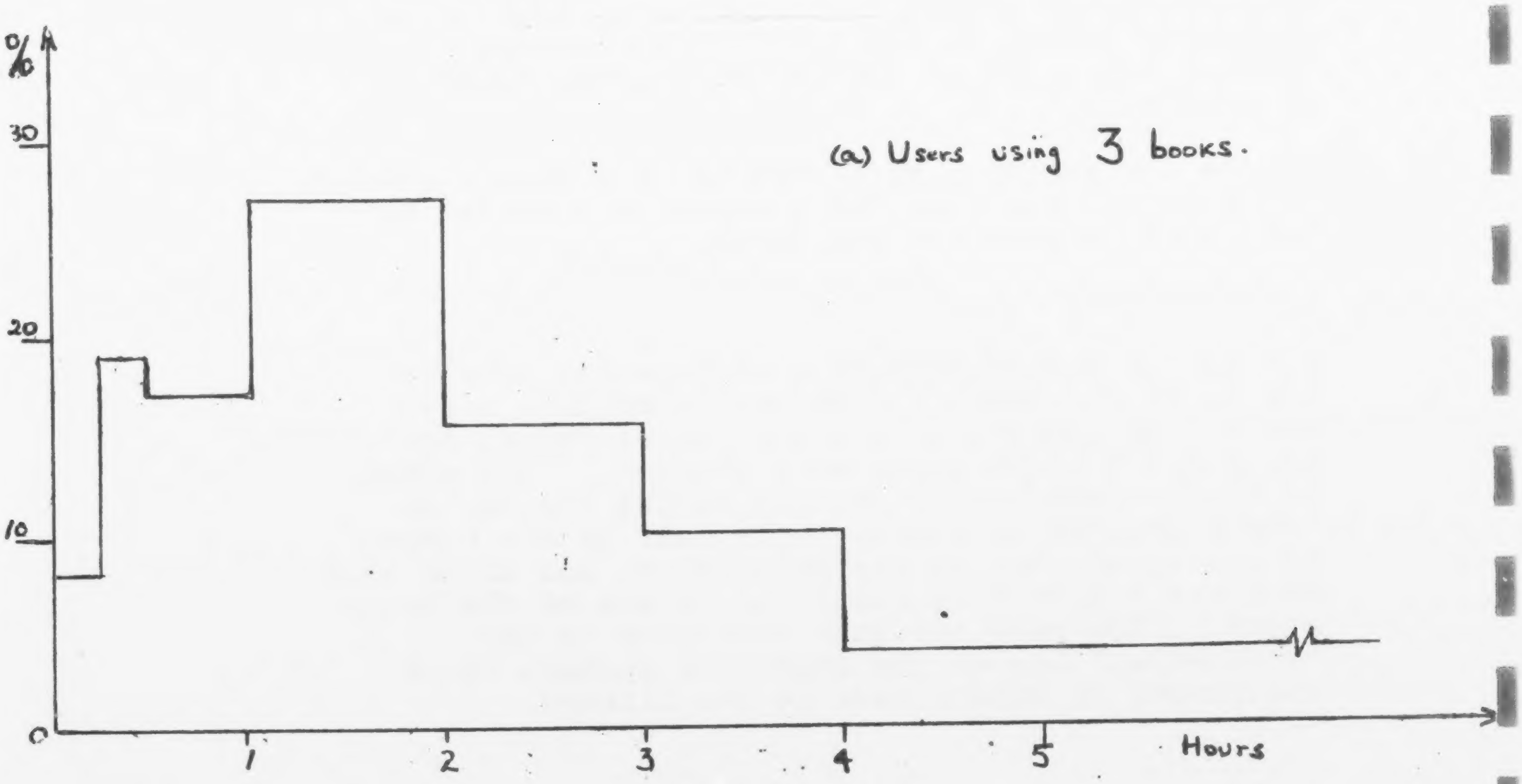
During the summer term in a university, library use is at its peak. Undergraduates make heavy use of the library as a place for studying, spending about 1.3/4 hours there at a stretch. The number of visits made to the library during one day by undergraduates is likely to be half of the number of undergraduates in the university, and about half of these visits will result in no use of the bookstock. The most reliable indicator of the "unrecorded" use of the bookstock appears to be the number of visits made to the library.

Reference

Fussler, H.H. & Simon, J.L.	1961	Patterns in the use of books in large research libraries, Chicago, University of Chicago Library

A8.10

FIG. 1: NEWCASTLE: % of users spending up to 1, 2, 3 etc. hours in the library


(a) Users using 3 books.

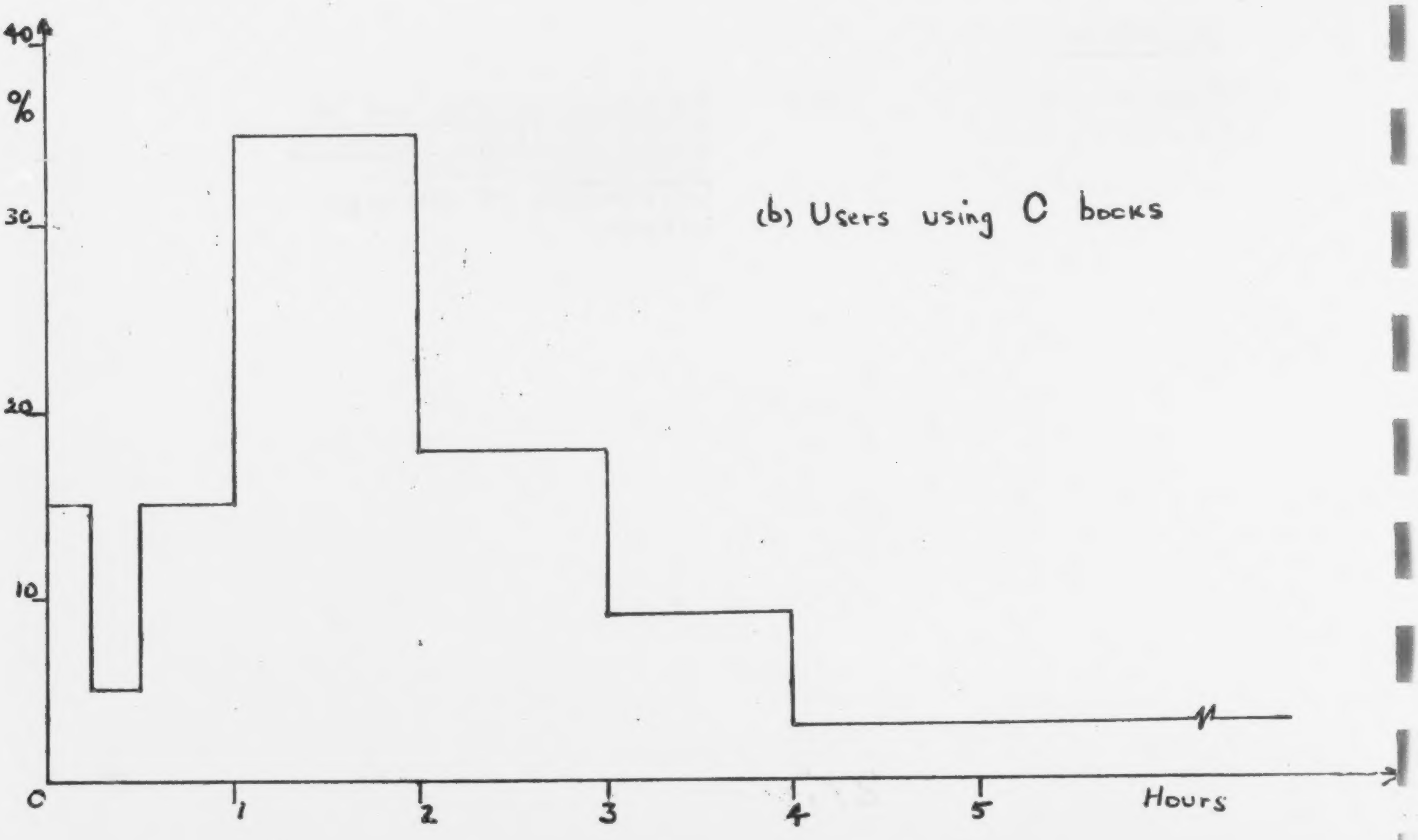
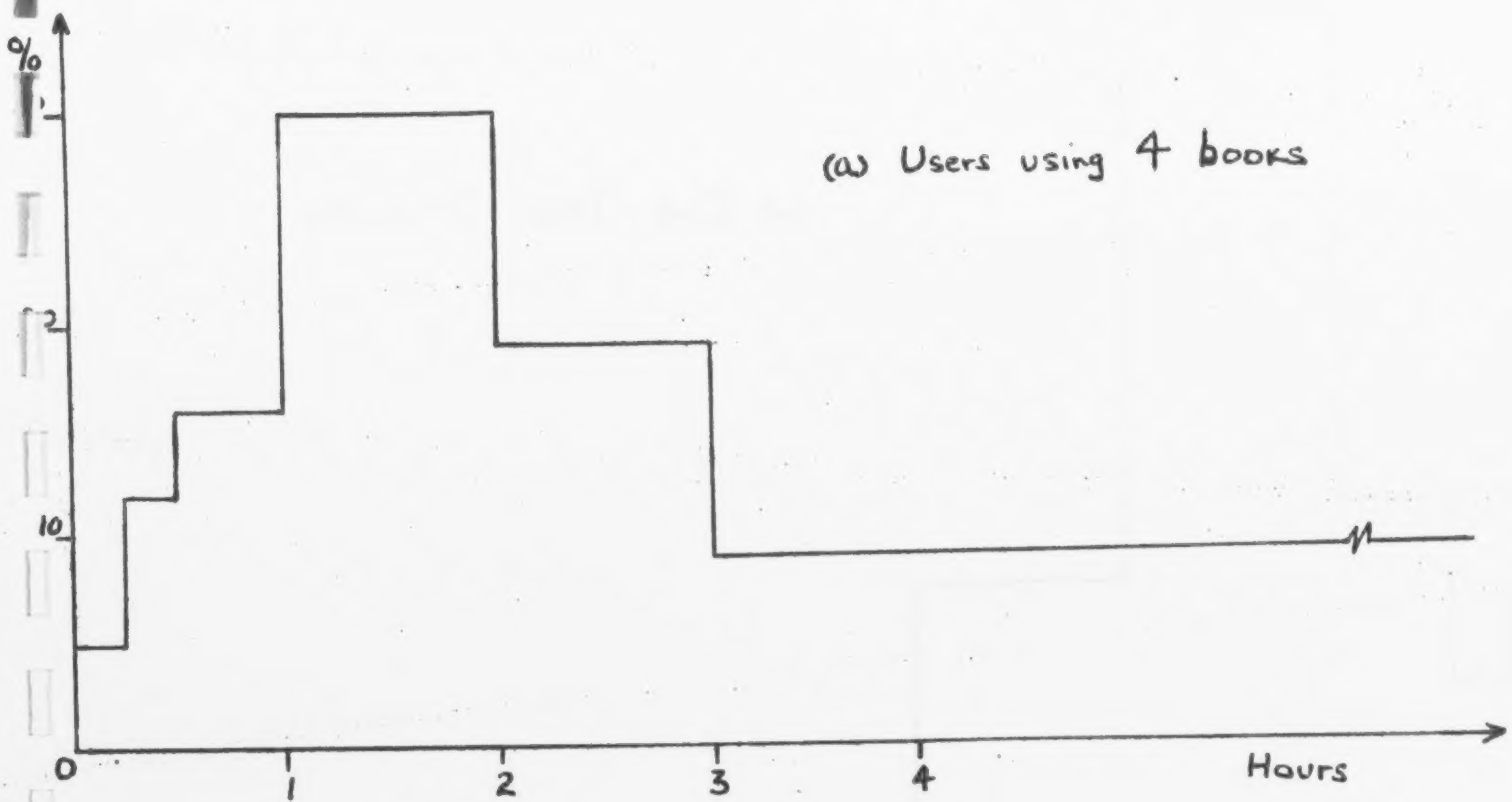
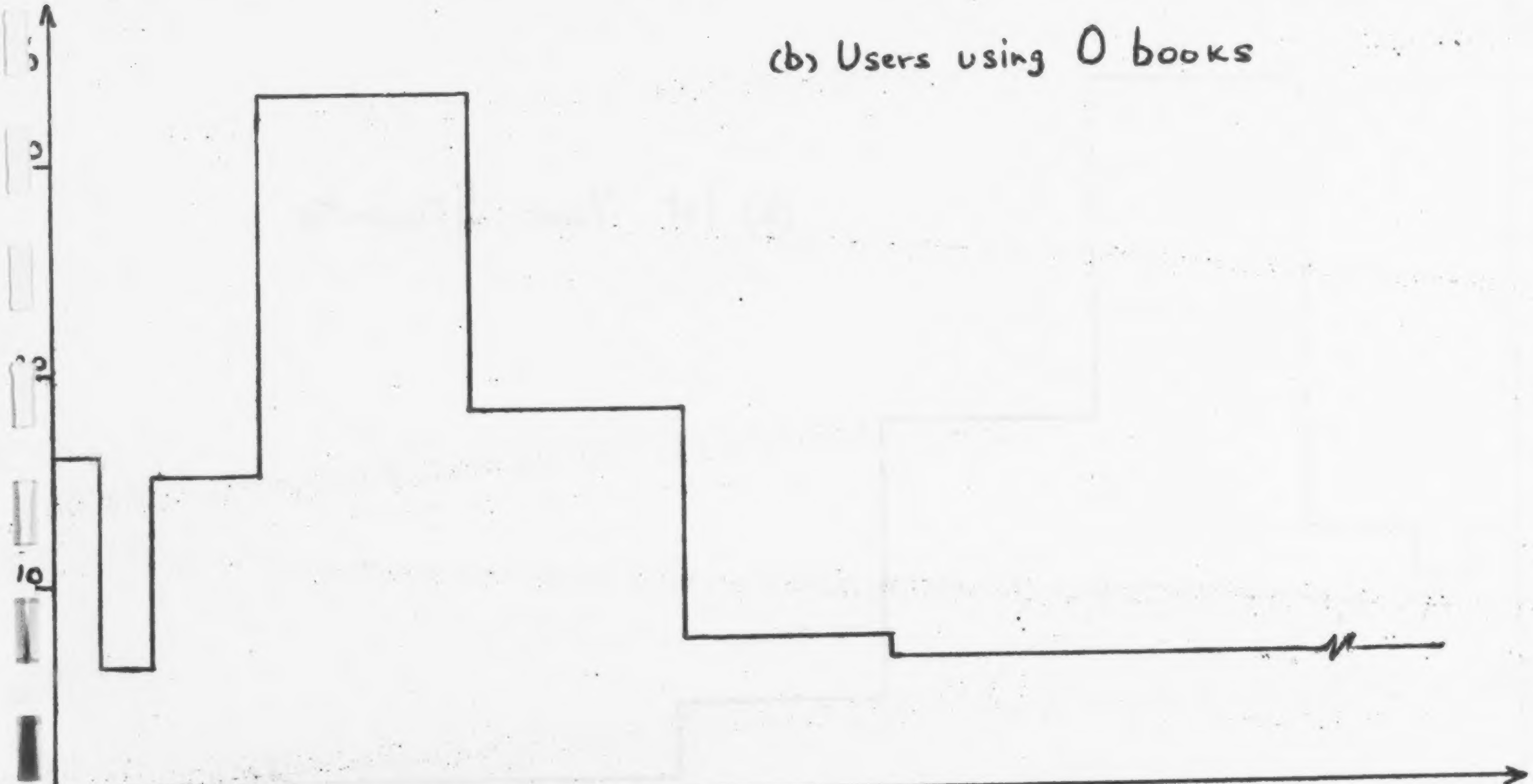

(b) Users using C books

FIG. 2: DURHAM ARTS/SS: % of users spending up to 1, 2, 3 etc. hours in the library



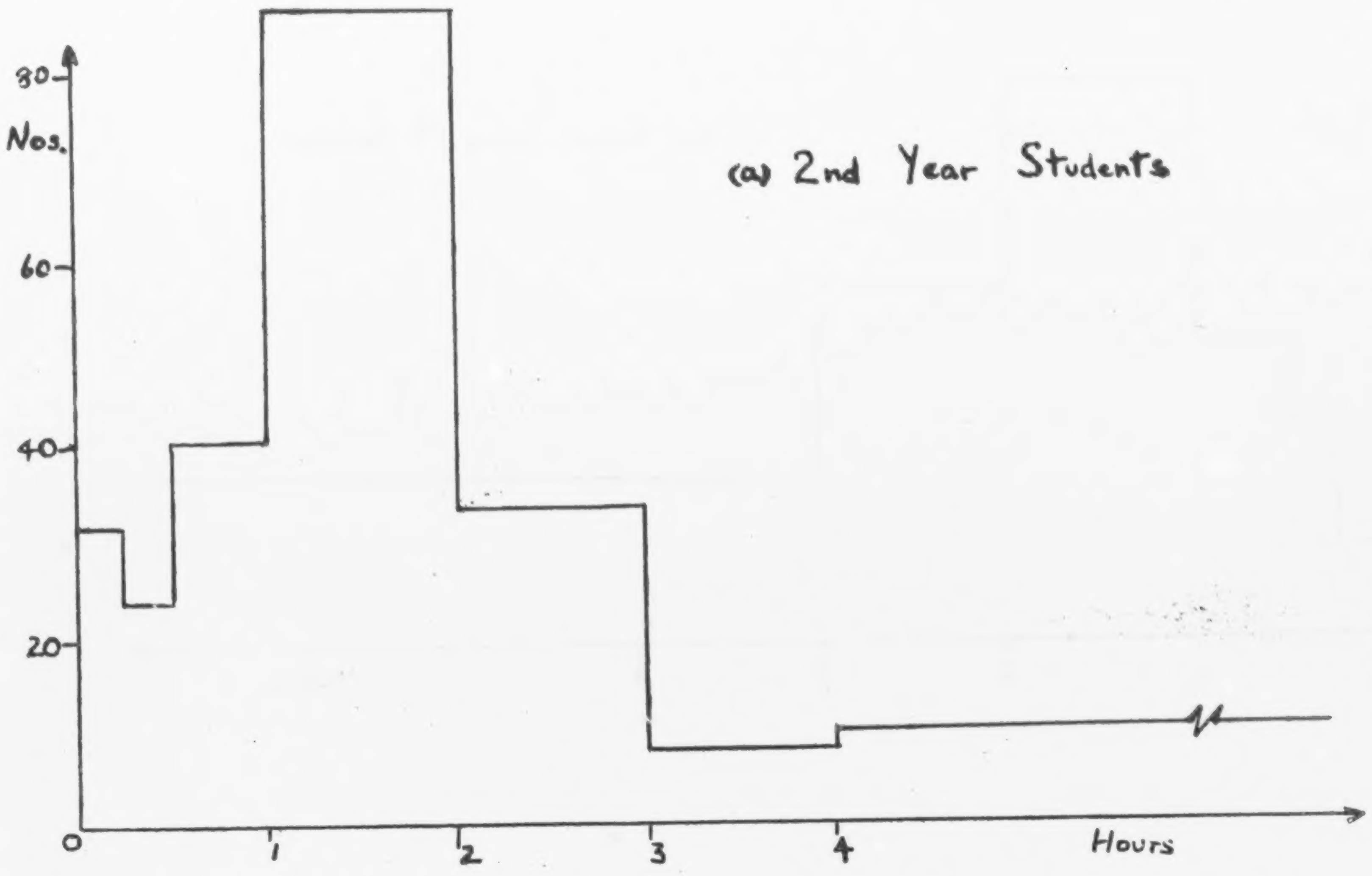
(a) Users using 4 books



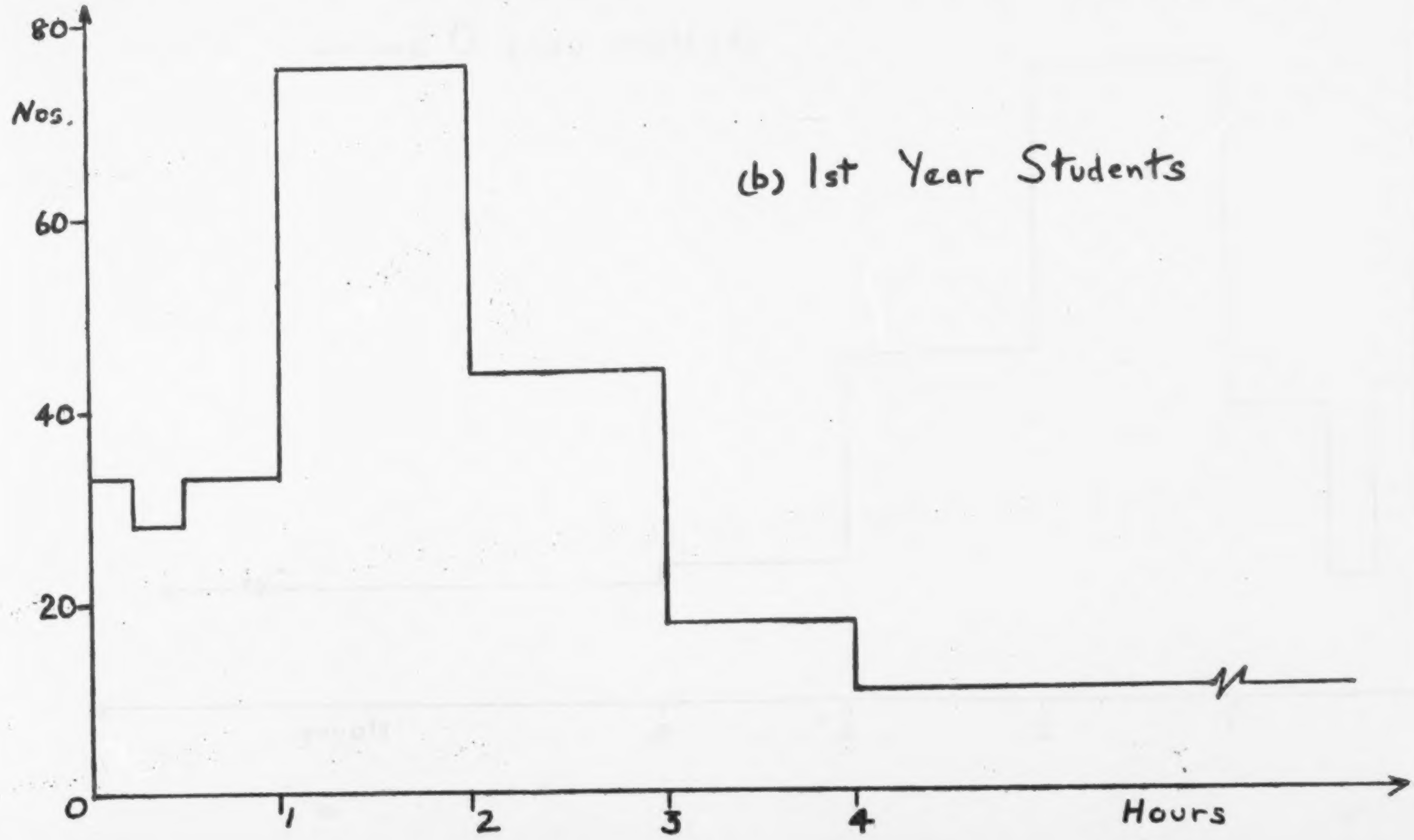
(b) Users using 0 books

A8.12

FIG. 3: DURHAM ARTS/SS: Nos. of undergraduates spending up to 1, 2, 3 etc. hours in library

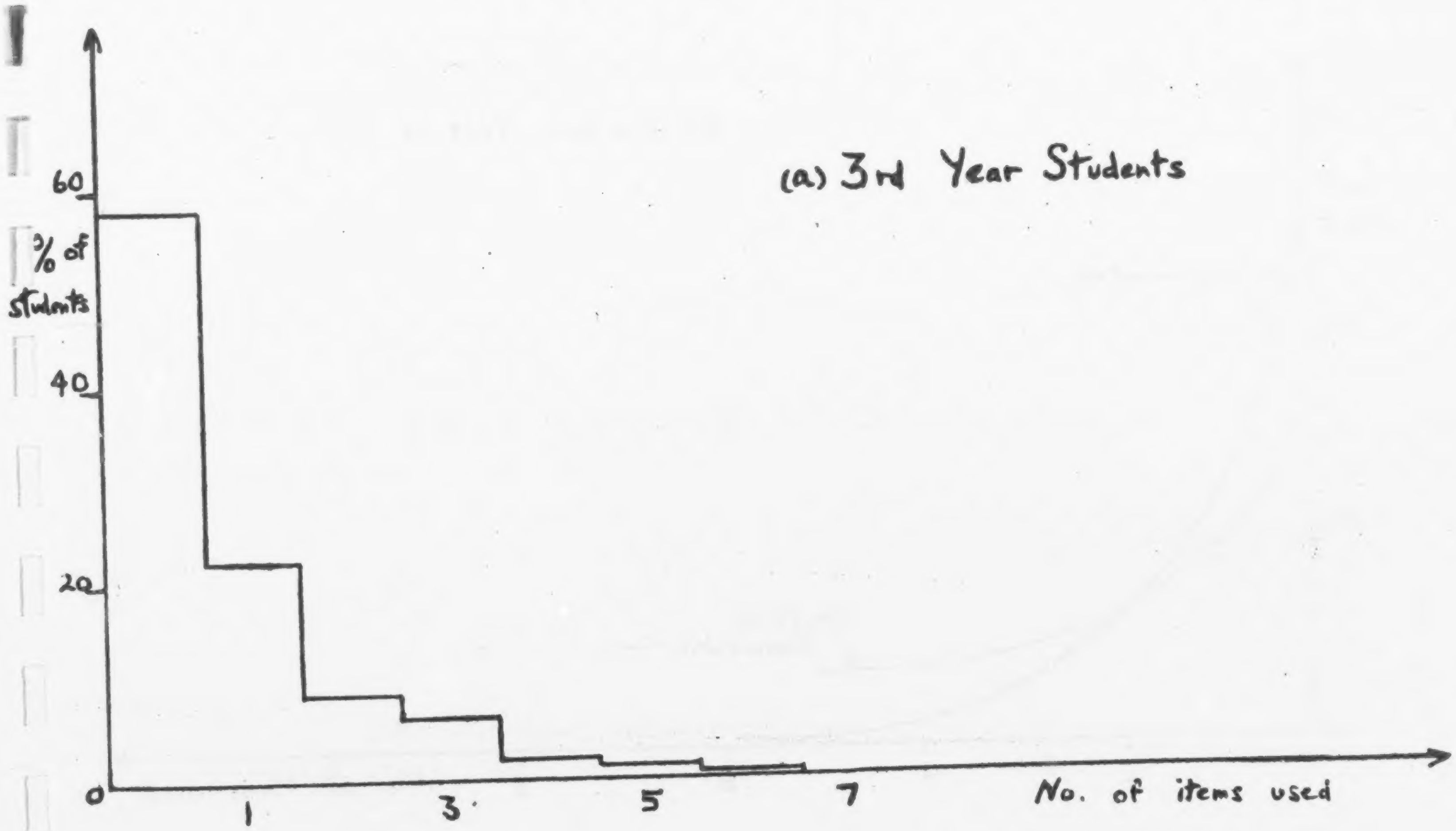


(a) 2nd Year Students



(b) 1st Year Students

FIG. 4: DURHAM SCIENCE: % of undergraduates using 0, 1, 2 etc. items



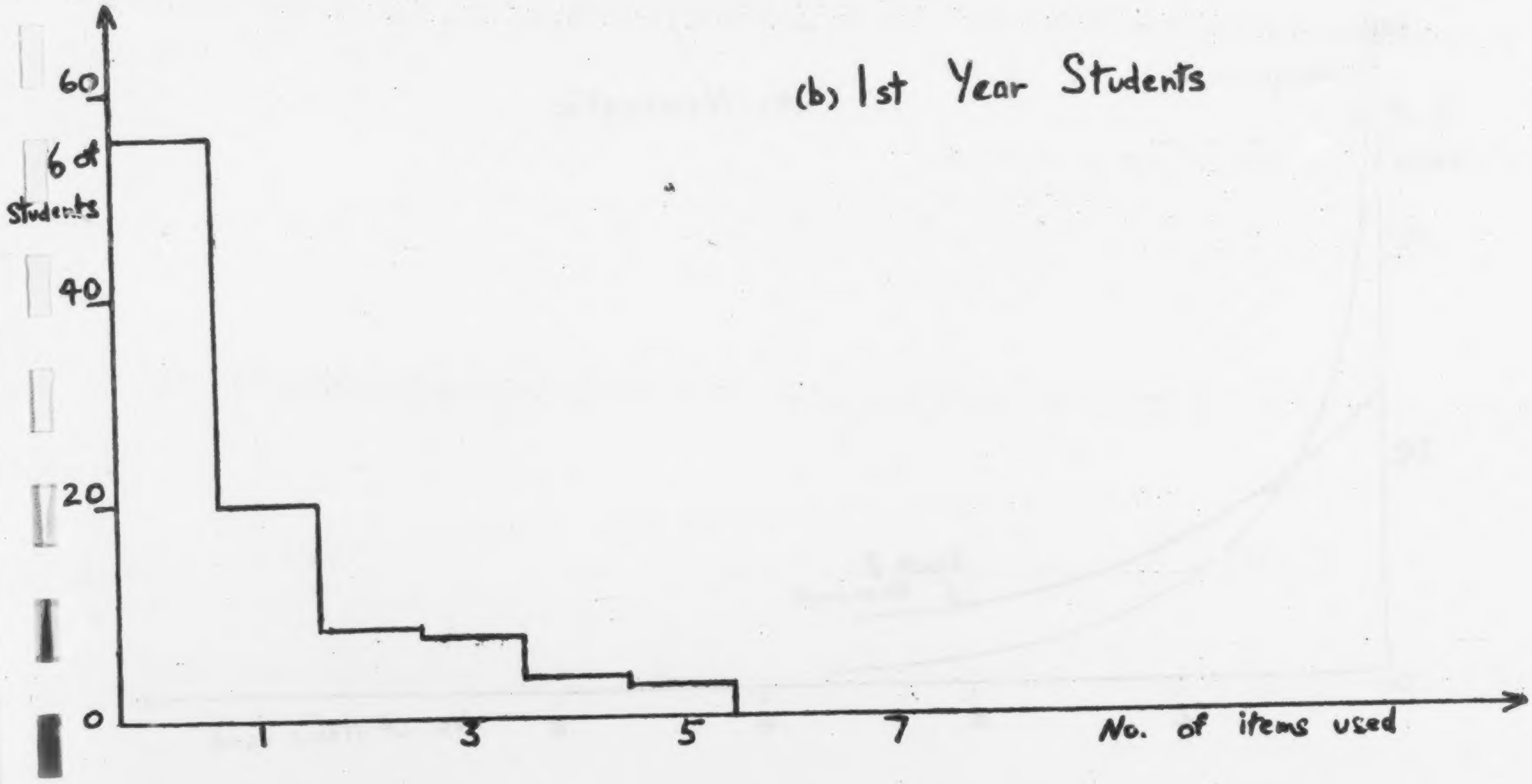


FIG. 5: DURHAM SCIENCE & NEWCASTLE: % of users 0, 1, 2, etc. items